Research Triangle Institute

October 1983

RTI Project 44U-2507
Contract No. EMW-C-0707
FEMA Work Unit 1611C

FINAL REPORT

RTI/2507/00-01F

NATIONAL UNDERGROUND MINES INVENTORY

Prepared for:
Federal Emergency Management Agency
Washington, D.C. 20472

Approved for Public Release; Distribution Unlimited

October 1983

RTI Project 44U-2507
Contract No. EMW-C-0707
Work Unit 1611C

FEMA Review Notice

This report has been reviewed in the Federal Emergency Management Agency and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Federal Emergency Management Agency.

FINAL REPORT

RTI/2507/00-01F

NATIONAL UNDERGROUND MINES INVENTORY

Prepared by:

M. Wright
R. Chessin
K. Reeves
S. York, III

Prepared for:

Federal Emergency Management Agency
Washington, D.C. 20472

Approved for Public Release; Distribution Unlimited

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. A134607	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) National Underground Mines Inventory		5. TYPE OF REPORT & PERIOD COVERED Final September 1982 - October 1983
		6. PERFORMING ORG. REPORT NUMBER RTI/2507/00-01F
7. AUTHOR(s) M. Wright, R. Chessin, K. Reeves, S. York, III		8. CONTRACT OR GRANT NUMBER(s) Contract No. EMW-C-0707
9. PERFORMING ORGANIZATION NAME AND ADDRESS Research Triangle Institute Research Triangle Park, North Carolina 27709		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS Work Unit 1611C
11. CONTROLLING OFFICE NAME AND ADDRESS Federal Emergency Management Agency Washington, DC 20472		12. REPORT DATE October 1983
		13. NUMBER OF PAGES 80
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for Public Release; Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Underground Mines
Fallout Shelters
Crisis Relocation
Rapid Enhancement

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The purpose of this study was to identify and, to the extent that data are available, to characterize the underground, non-coal mines in the United States and to assemble the data obtained into a national inventory of underground mines having the potential of providing lodging and shelter as a civil defense measure during a natural or man-made disaster. Data were collected from the Mine Safety and Health Administration, the U.S. Bureau of Mines, from discussions with mine inspectors,

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. and from mine owners and operators during visits to six underground mines. The data collected were incorporated into a computerized underground mine data file at the FEMA/Olney Computer Center.

Abstract

The purpose of this study was to identify and, to the extent that data are available, to characterize the underground, non-coal mines in the United States and to assemble the data obtained into a national inventory of underground mines having the potential of providing lodging and shelter as a civil defense measure during a natural or man-made disaster. Data were collected from the Mine Safety and Health Administration, the U.S. Bureau of Mines, from discussions with mine inspectors, and from mine owners and operators during visits to six underground mines. The data collected were incorporated into a computerized underground mine data file at the FEMA/Olney Computer Center.

TABLE OF CONTENTS

I. INTRODUCTION

In recent years, civil defense planners have emphasized two major alternatives for protecting the civilian population in the event of a nuclear attack on the United States. The first alternative--implemented should an attack occur suddenly, without warning--consists of sheltering the population in the immediate vicinity of its locale at the time of attack. The second alternative--implemented during a period of international tensions that could lead to war--consists of relocating (evacuating) populations of likely target areas into areas of lower risk where shelter from fallout would be provided. The success of both alternatives depends on the availability of suitable lodging and weapons effects shelter.

Federal civil defense officials have for a number of years been seeking low-cost means of providing lodging and shelter. To this end, a civil defense rapid enhancement concept was developed under which plans are made whereby civil defense capabilities can be improved by a concentrated effort over a relatively short period of time ranging from a few weeks to a year or more. These efforts would be initiated under conditions of heightened international tensions. Previous civil defense research at RTI [Ref. 1] has shown that underground mines can be made usable as shelters in a short period of time and at a low cost; therefore, these facilities appear to be ideally suited for incorporation into rapid enhancement plans.

Under the National Shelter Survey (NSS), underground mines near metropolitan areas were surveyed and are identified in the NSS data files. However, unsurveyed mines that are remote from metropolitan areas could prove to be a valuable resource for the crisis relocation option. The research program described herein had the objectives of identifying and characterizing

all underground mines in the continental United States and of developing an approach for incorporating underground mines into the civil defense rapid enhancement concept. Since the number of underground mines located in risk areas (and subject to high blast overpressures) is relatively small, the emphasis of this study was toward their use as congregate lodging and fallout shelters rather than as direct effects shelters.

Effective use of underground mines as crisis shelters is a function of several factors:

- Mine location and physical character,
- Mine environment, and
- Resource availability for mine upgrading.

Mine location is important in determining its usefulness either as a risk-area or host-area shelter. Location is also an important determinant of accessibility for occupants and timely delivery of materials and supplies. In host areas, fallout radiation protection is the primary function of shelters, although low-level blast effects may also be experienced. Underground mines provide excellent fallout protection by virtue of the shielding provided by the earth cover and most mines would not be affected by low-level blast overpressures. In risk areas, shelters must provide protection from all weapons effects including blast, thermal pulse, and initial nuclear radiation, as well as fallout. The earth cover provides excellent protection from the initial nuclear radiation, thermal pulse, and fallout radiation with the exception of areas near entranceways of drift-entry mines. Most underground mines also provide good blast protection, although quantification of blast protection requires a detailed analysis of each mine. Data important to such an analysis include geologic formations around the mine; mine age; mine entranceway type, size, and number; mine volume and interior configuration;

mine depth; mine support characteristics; and hoist equipment susceptibility to blast damage. Usable floor area, means of ingress and egress, and adaptability to upgrading make up the physical character of a mine. Each of these parameters is an important determinant of a mines usefulness as a fallout shelter.

The internal environment of a mine is made up of thermal, chemical, and biological characteristics of the mine atmosphere. Thermal characteristics include temperature and humidity; chemical characteristics refer to the chemical makeup of mine air, which may include toxic geses; and biological characteristics refer to the potential presence of disease-producing agents within a mine. Each of these environmental elements must be within a habitable range in mines used as personnel shelters.

In their natural state, most mines would not be suitable for housing large numbers of people. As a minimum, lighting and ventilation systems will need to be added or upgraded. Expedient means of adding or upgrading these items should be available during a rapid enhancement period and should make use of readily available materials and equipment to the extent possible. Hence, the availability of upgrading resources is an important consideration in evaluating a mines fallout shelter potential.

The project described herein had objectives of identifying all U.S. underground mines that have the potential of being used as crisis shelters, obtaining, to the extent that data are publicly available, information that could be used to evaluate each mine's shelter potential, and assemblying the collected information into a computerized national inventory of underground mines compatible with the TENOS* civil defense operating system model.

---

* TENOS - Test and evaluation of National Operating Systems.

While a great deal of success was achieved in the first and third objectives, progress toward the second objective was quite limited. Work performed and results achieved during the course of the project are described in the following sections.

II. MINE INVENTORY DEVELOPMENT

The first part of the study involved development of a national inventory of underground mines and was carried out in two phases: a data collection phase and a data file preparation phase. Data collection consisted of purchasing computer files, written and telephone solicitations, and field visits to mining operations. Data file preparation consisted of assembling and computerizing the collected data, estimating missing data elements, and calculating needed parameters.

A. DATA COLLECTION

1. Examination of Data Files

The initial data collection task was the purchase of the most recent list of U.S. mines from the Department of Labor, Mine Safety and Health Administration (MSHA). The list was obtained on computer tape and represents the status of metal and nonmetal mines at the end of the second quarter of 1982. Some of the important data elements contained in the MSHA file for each mine include: an identification number, name, location (state and county), Standard Industrial Classification (SIC) code for the primary commodity mined, current status of mining operations, mailing address, and a code identifying the mine as a surface or underground operation. Because this study is concerned only with underground mines, the purchased data file was processed to create a new data file pertaining only to underground mines. This new data file served as the basis for the national underground mines inventory.

Once the mine listing was obtained, descriptive information for each mine was solicited through contacts with district, subdistrict, and field offices of MSHA. Contacts were made by mail and by telephone. Information requested

included mine location, estimated mined out area, entry type, wetness data, toxic gas data, and mining status. In most cases, staff members at subdistrict or field offices were able to supply the information requested.

From initial contacts with MSHA offices, it was learned that the MSHA Safety and Health Analysis Center in Denver had compiled an information file describing mine hoist systems for approximately 75 percent of U.S. mines with hoisting equipment. Copies of the hoist information forms were requested and subsequently provided to the project staff. Information from the hoist data file was matched with other information by matching mine identification numbers.

Information files maintained by MSHA did not generally contain all of the data needed to assess a mine's shelter potential. The data obtained from MSHA showed a great deal of variation in usefulness for civil defense purposes. In some cases, followup conversations to clarify or supplement written communications were adequate for our needs, while in other cases, desired information was unavailable. In the latter cases, estimates or assumptions were made to complete the missing data when practical.

The data tape purchased from MSHA does not contain information on abandoned mines. Because abandoned mines are potentially useful as shelters, efforts were made to identify these mines. Two important sources of abandoned mine data were identified: (1) the U.S. Department of Interior's Bureau of Mines (BOM) and (2) MSHA supervisors and field inspectors. The BOM Minerals Availability Field Office (Denver) has developed an inventory of both operating and abandoned mines which includes underground mines for metals of strategic importance. RTI obtained a listing of their computerized data file which, for each mine listed, identifies mine name, mine owner, county location, longitude and latitude, commodity mined, date of data entry, depth

and number of shafts, condition of mined out area, and amount of mined out area. The BOM information is more extensive than that available from MSHA; however, it's availability is somewhat limited for certain metals (gold, for example) and it is unavailable for most nonmetals. Information relating to internal conditions (e.g., wetness data) of mines was frequently not available in the BOM file. Such mines are included in the mine inventory even though they may not be of use to Civil Defense Rapid Enhancement plans. Before any mines in this category are incorporated into civil defense plans, more definitive information regarding their shelter potential must be obtained and evaluated by civil defense planners.

In addition to the BOM data on abandoned mines, MSHA personnel identified mines that are not found on present MSHA computer files. In most cases, the mines were known to have been taken off the computer lists for some reason but were also known to have been developed and were thought to be in a condition to provide shelter. In eastern states, abandoned mines are predominantly nonmetal while in rocky mountain and western states, they are predominantly metal. Abandoned nonmetal mines were identified in both the northeast and northcentral MSHA districts.

It is unlikely that all abandoned mines in the country were identified during this project; however, information on the Bureau of Mines printout, which identifies metal mines, combined with information obtained from MSHA district, subdistrict, and field offices, which predominantly relates to nonmetal mines, provides a relatively thorough inventory of abandoned underground mines. For most of the abandoned mines, no shelter space number has been estimated because of uncertainty regarding the condition and size of the mine.

2. Mine Visits

Because much of the mine information was obtained orally and is based on imprecise estimates by MSHA inspectors, field visits were made to six mines to obtain, first hand, a feel for conditions in and around actual underground mines. The mine visits provided the project team with a sound basis for inperpreting the information provided by MSHA. The visits also provided the project team with practical insights into the interior configuration and conditions in a variety of metal and mineral mines where various mining methods are used. The six mines were selected to represent a cross-section of mines by geographic location, commodity mined, entry type, and mining method used. The six mines visited were:

(1) Weeks Island Mine; Morton Salt Company; Weeks Island, Louisiana; salt.

(2) San Manuel Mine; Magma Copper Co.; San Manuel, Arizona; copper.

(3) Homestake Mine; Homestake Mining Co.; Lead, South Dakota; gold.

(4) Volmeyer Mine; Columbia Quary Company; Columbia, Illinois; limestone.

(5) Friedensville Mine; N. J. Zinc Co.; Friedensville, Pennsylvania; lead-zinc.

(6) Whitestone Mines (No.1); Georgia Marble Co.; Whitestone, Georgia; limestone marble.

The three metal mines and the salt mine are multilevel mines. All four have shaft entries and, in addition, the Friedensville mine has an inclined portal entry that is used for vehicular traffic. The two limestone mines are single level mines with portal entries.

Most of the general information provided by MSHA personnel on these six mines was determined during the visits to be accurate. However, for two mines, substantial differences were found in the size estimates provided by

MSHA and those provided by mine personnel. For these mines, the size information obtained at the mine site was considered to be more up-to-date and, consequently, more accurate. Differences were also found in the hoisting capabilities estimated from MSHA records and that found during the mine visit. These differences were taken into account in the values entered in the data file.

Internal conditions of the mines visited were generally favorable to their use as civil defense shelters. Excessive temperatures were found only in one mine, the Homestake Mine, Lead, South Dakota. In this mine, drifts below the 4,000 foot level have temperatures in excess of 85° F. Consequently, these lower levels may not be suitable as shelters. Mine wetness was discussed with mine personnel and was carefully inspected during the visits. Based on these discussions and observations, mine wetness is not expected to present major problems even in mines considered to be extremely wet, such as the Friedensville Mine. RTI found that significant portions of wet mines are usable as shelter. None of the mines visited contained toxic gases other than blasting products.

Heavily timbered mines with no natural ventilation may become oxygen deficient over time because of oxygen absorption by wood during the aging process. Such an oxygen deficiency could be hazardous to individuals entering a mine for the first time unless some form of forced ventilation is used. In timbered mines, the oxygen content of the air inside should be measured before being used as shelter or lodging.

In addition to providing a basis for interpreting data from other sources, the mine visits also provided an opportunity to review the

availability of resources at or near mine sites. Electricity, fuel storage, water, communication systems, transportation, and waste disposal facilities are resources that are used in active mining operations and would be useful during a shelter period. Based on personal inspection during the mine visits, the project staff concluded that at most mines, electrical power is provided by a local electric utility and that most mines do not have emergency generators. It was also observed that diesel fuel is commonly used in mining equipment and is frequently stored inside shaft mines for convenience. Potable water is frequently not piped into the mine but water is available on the surface and is carried into the mine in containers for use by underground workers. The naturally occurring water in some mines is potable without treatment.

Toilets are available inside mines but the number is not adequate for a shelter population. All six of the mines visited had toilets, showers, and washing facilities near the mine entrance at ground level. Telephones and/or radio phones are generally placed throughout mines for communication within the mine and with the surface. Audio paging systems are also sometimes found in mines. Existing communication systems could prove to be extremely useful in shelter situations.

All of the mines visited were served by a well maintained roadway. This is likely to be the case at most mines although a few mines are well removed from paved roads and may not be easily accessible by ordinary vehicles. Many mines are served by railroads which could be used to transport people and supplies.

While observations of available resources during the mine visits provide a very general idea of useful resources that may be available at mining sites, detailed civil defense plans will require that each mine in the inventory

be investigated to determine the resources available and the additional resources required to upgrade them to a useful civil defense shelter. The following discussion covers specific characteristics of each mine visited.

a. Weeks Island Mine, Morton Salt Company.

The MSHA file lists three mines for Morton Salt Company at the Weeks Island location, one active, and two abandoned. All three reside in the same salt structure called a salt dome. A large part of the "abandoned" mine is used to store petroleum as part of the U. S. strategic reserves. The site is served by rail, barge, and highway and is within approximately two hundred yards of the Gulf of Mexico. Emergency generators are maintained at the site to provide power to the fans and hoists during electrical outages. A 1,000 gallon storage tank for diesel fuel is located inside the mine and a 3,000 gallon tank is located on the surface. Water is piped to the mine from an onsite chemical plant which operates a water treatment system. Four nearby lakes provide water to the plant, mill, and mine.

MSHA data related to the size and condition of the Weeks Island Mines were quite accurate; however, the MSHA hoist file did not contain sufficient detail to permit an accurate assessment of hoist capacity for civil defense use. Based on discussions with the plant manager, hoist capacity was estimated at 460 persons per hour. The MSHA records indicated a capacity of 280 persons per hour.

b. San Manuel, Magma Copper

MSHA data on the San Manuel copper mine were somewhat limited. The mine was identified as a large mine, but the actual amount of open floor area is not large because of the mining method used. In removing the ore, stopes are blasted in such a way that as the ore is removed, the overburden is allowed to settle into the mined out stopes. Therefore, only those haulage lines and

drifts that are currently under development are habitable and previously mined out levels do not exist. Although the haulage lines provide considerable space, this particular mining method does not leave large areas that can be used as shelter.

During mine development, pockets of water are sometimes encountered in the rock structure and must be pumped out. Nevertheless, the mine is considered dry so that its entire area is useable as shelter. Only a small volume of water collects in the mine at the sump level.

c. Homestake Mine, Lead, South Dakota

The Homestake Mine is an old, widely known gold mine. Although MSHA provided many details regarding the physical features of the mine, additional information related to mine temperature was obtained during the mine visit. The temperature inside the mine increases by approximately 1° F per 100 feet as one moves downward from the surface. At the 8,000 foot level, the air temperature is 134°F. These high temperatures could prevent the use as shelter of over 50 percent of the habitable mine area unless cooled air is used to ventilate the warmer levels. For current operations, approximately 5,000 cubic feet per minute (CFM) of ventilating air is provided to each drift to keep temperatures tolerable .

The Homestake mine is an active mine but the mining method uses extensive backfilling which keeps the usable shelter space relatively small compared to the space generated when backfilling is not used. Because of the temperature problems and the use of backfilling, the usable area in the Homestake Mine is likely to stay relatively constant.

A portion of the mines electrical needs is supplied by a small company-owned hydroelectric facility. Although for full mining operations,

power is purchased from an electric utility, the company-owned plant is adequate for lighting and partial hoist operations. This independent source of electricity could be a valuable asset during a crisis condition. The mine contains a large concrete-lined, underground water storage tank with a capacity of 2 million gallons. The water is potable and would be especially useful in a shelter situation.

The mine has one inactive hoist in place, which, according to mine personnel, could be made operable within 24 hours, if needed. This feature could also be very valuable in using the mine as a Civil Defense shelter.

d. Friedensville Mine, New Jersey Zinc

The Friedensville mine is the wettest of the six mines visited. Nevertheless, it is an attractive mine for shelter purposes. The extensive water drainage system is well designed to minimize water accumulation on the drift levels. In many areas, sufficient water has accumulated to make the use of boots a necessity, but there are also many areas that are free of standing water. The MSHA data accurately characterized the nature of the mine. At one time, this mine was allowed to flood, with the result that approximately one-third of the mine filled with water. Should the mine cease operation in the future one could assume that no more than one-third of the mine would flood and that the remainder of the mine would remain habitable.

Entrance to this mine is by vertical shaft or by a 2-mile long inclined portal which also is used for ventilation. Drinking water is tapped within the mine and is estimated to be available in adequate quantities to support a shelter population. Washing and toilet facilities are also available inside the mine.

e. Valmeyer Mine Columbia Quarry Co. and Whitestone Mines, Georgia

The two limestone mines are very similar and will, therefore, be discussed together. As is apparently the case for most limestone mines, these are single level mines except for one of the five Whitestone mines, which has two levels. For the Valmeyer mine, floor area estimates by MSHA personnel and those by mine personnel were in good agreement, but for the Whitestone mines there were significant differences in area estimates.

The mines are quite dry, cool, and easily accessible by vehicles. The Valmeyer mine has approximately 25 openings into the limestone structure and consequently has excellent natural ventilation. However, the large number of openings adversely affects radiation protection in the vicinity of the openings, which would reduce the capacity of the mine as a fallout shelter.

These limestone mines do not contain the water, toilet, and communication networks that are found in large shaft-entry mines. All parts of the mine are easily accessible by vehicles and mine personnel move in and out of the mine easily and regularly as needed. Consequently, support facilities can be located outside the mine and still be readily accessible. Upgrading mines of this type for shelter use should be much easier than upgrading large shaft-entry mines because of easy entry, good access, and a more pleasant environment inside the mine.

B. DATA FILE PREPARATION

The initial source of information for the data file was a mangetic tape file of the MSHA second quarter 1982 Metal/Nonmetal Address/Employment Data. At the request of RTI, coal mines had been purposely eliminated from the file due to potential safety problems related to their use as civil defense shelters. The format in which data are arranged in this file is shown in Figure 1.

Character Positions	Data Element	Picture	Description
1-7	Mine ID	Pic 9(7)	MSHA Mine ID assigned to a mining operation.
8-10	Contractor	Pic X(3)	Contractor performing work at the site of the primary Mine ID operation. Blank if owner. Coal = 1 alpha - 2 numeric characters. metal/nonmetal numeric only.
11-12		Pic 99	
12-16	Inspection Office	Pic 9(4)	Code for MSHA Field office exercising jurisdiction over this mining operation. First two characters = District. First three characters = Subdistrict. All four characters designate Field office.
17-18	State Code	Pic 99	FIPS code for state in which mine is located.
19-21	County Code	Pic 999	FIPS code for county within a state in which mine is located.
22-26	SIC	Pic 9(5)	Standard Industrial Code for primary commodity mined.
27	Canvass or Class	Pic 9	Designate a general product class based on SIC code.
28-29	Mine Type	Pic 99	Metal/Nonmetal mine type code. Based on subunit operations code and canvass code.
30	Status Code	Pic X	Code for status of operations of mine (active to permanently closed.) Coal = Alpha A through H. Metal/Nonmetal = Numeric - 1, 2, and 3.
31-36	Status Date	Pic X(6)	Date of latest add or change of status. YYMMDD.
37-40	Seam Height	Pic 9(4)	Coal seam height in inches. Coal only.
41-42	Education & Training Indicator	Pic 99	MSHA Education and Training District office having jurisdiction over this mine.
43	Surface/Underground District	Pic X	Indicator for Education and Training showing surface or underground. U = underground; S = surface.
44-46	Travel Area	Pic X(3)	Metal/Nonmetal inspection travel area. 1 alpha and 2 numeric characters.
47	Mailing Control	Pic 9	Provides for suppression of mailouts. = all mailouts; = suppress selected mailouts.
48-77	Company Name	Pic X(30)	Company owning or having primary responsibility for the operation of this mine.
78-107	Mine or Plant Name	Pic X(30)	Name applied to this mine by the company.
108-137	Street or PO Box Number	Pic X(30)	Mailing address for this mining operation.
138-150	City	Pic X(13)	City to which mail is sent for this mine.
151-152	State Abbreviation	Pic XX	State abbreviation for mailing purposes.
153-157	Zip code	Pic 9(5)	Zip Code for mailing purposes.
158-181	County Name	Pic X(24)	Name of county in which mine is located.

Figure 1. Original MSHA File Format

Character Positions	Data Element	Picture	Description
			The next two items represent information supplied quarterly by the mining company on Form 7000-2. They may not accurately reflect actual accidents/illnesses reported. Occurs 4 times - once for each reporting quarter.
182	Injury Flag	Pic 9	Company statement that this company had reportable injuries or illnesses during this report quarter. 1 if yes; 2 if no.
183-185	Injury Count	Pic 9(3)	Number of reportable accidents and illnesses given on employment form.
198-199	Filler	Pic XX	No longer needed information.
200-201	Update Addition Year	Pic 99	Year address information was added to file.
202-204	Update Addition Year	Pic 999	Update cycle number address information was added to file.
205-206	Update Change Year	Pic 99	Year of latest change to address information.
207-209	Update Change Number	Pic 999	Update cycle number of latest change to addresses information.
210	Subunit Operations (number)	Pic 9	Number of subunit operations (formerly department) for this ID. Employment trailer count.
			The next 7 items occur from 0 to 4 times according to the employment trailer in character position 210.
211	Subunit Code	Pic 9	Subunit Code.
212-216	Men	Pic 9(4)	First quarter employment count for subunit code.
217-224	Man-hours	Pic 9(8)	First quarter total man-hours worked under subunit code.
225-234	Production	Pic 9(10)	First quarter pounds of mined commodities.
235-257			Men, man-hours, and production fields for second quarter.
259-281			Men, man-hours, and production fields for third quarter.
282-304			Men, man-hours, and production fields for fourth quarter.

Figure 1. Original MSHA File Format (continued)

A procedure employing a FEMA Computer Center (FEMACC) utility was developed to extract the MSHA information from the tape data file for use in developing the National Inventory of Underground Mines. Once the data were extracted, the first 210 data columns, were reformatted into three 80-column card records for each underground mine. The 80-column format was chosen for ease in manual editing through a remote terminal. The format of the 80-column card file, which was used in all subsequent processing steps to represent the MSHA data, is shown in Figure 2.

The MSHA data did not include a number of information items that are desirable in a mine inventory. For example, latitude and longitude, mine size, number and types of mine entries, and the number of shelter spaces in each mine. These data and other relevant data were obtained from MSHA field offices and other sources, as described earlier, and were manually entered into a supplemental mine information file. After the supplemental information file was verified, the file was sorted by 7-digit Mine ID so that its order then matched that of the MSHA data. The record format of the supplemental mine information file is presented in Figure 3. It should be noted that numeric fields, such as latitude/longitude and number of spaces, are generally left blank, as is any field, when the information is unknown, whereas the value "0" represents a known entity.

The following paragraphs describe the information included in the supplemental mine data file, discusses the procedures for quantifying or estimating each data element, and describes shortcomings and discrepancies in the data.

Card 1

Character Positions	Data Element	Picture	Description
1-7	Mine ID	Pic 9(7)	MSHA Mine Id assigned to a mining operation.
8-10	Contractor	Pic X(3)	Contractor performing work at the site of the primary Mine ID operation. Since only owner records kept on this file, blank in all cases.
11-12		Pic 99	
12-16	Inspection Office	Pic 9(4)	Code for MSHA Field office exercising jurisdiction over this mining operation. First two characters = District. First three characters = subdistrict. All four characters designate Field office.
17-18	State Code	Pic 99	FIPS code for state in which mine is located.
19-21	County Code	Pic 999	FIPS code for county within a state in which mine is located.
22-26	SIC	Pic 9(5)	Standard Industrial Code for primary commodity mined.
27	Canvass or Class	Pic 9	Designate a general product class based on SIC code.
28-29	Mine Type	Pic 99	Metal/Nonmetal mine type code. Based on subunit operations code and canvass code.
30	Status Code	Pic X	Code for status of operations of mine (active to permanently closed.) Coal = Alpha A through H. Metal/Nonmetal = Numeric - 1, 2, and 3.
31-36	Status Date	Pic X(6)	Date of latest add or change of status. YYMMDD.
37-40	Seam Height	Pic 9(4)	Coal seam height in inches. Coal only. Meaningless for the records on this file.
41-42	Education & Training District	Pic 99	MSHA Education and Training District office having jurisdiction over this mine.
43	Surface/Underground Indicator	Pic X	Indicator for Education and Training showing surface or underground. U = underground; S = surface.
44-46	Travel Area	Pic X(3)	Metal/Nonmetal inspection travel area. 1 alpha and 2 numeric characters.
47	Mailing Control	Pic 9	Provides for suppression of mailouts. = all mailouts; = suppress selected mailouts.
48-77	Company Name	Pic X(30)	Company owning or having primary responsibility for the operation of this mine.
78-79	Filler	Pic XX	Left Blank.
80	Card Identifier	Pic 9	Has value 1.

Figure 2. MSHA 80-column Card Format

Card 2

Character Positions	Data Element	Picture	Description
1-30	Mine or Plant Name	Pic X(30)	Name applied to this mine by the company.
31-60	Street or PO Box Number	Pic X(30)	Mailing address for this mining operation.
61-73	City	Pic X(13)	City to which mail is sent for this mine.
74-75	State Abbreviation	Pic XX	State abbreviation for mailing purposes.
76-79	Filler	Pic X(4)	Left Blank.
80	Card Identifier	Pic 9	Has value 2.

Card 3

Character Positions	Data Element	Picture	Description
1-5	Zip Code	Pic 9(5)	Zip Code for mailing purposes.
6-29	County Name	Pic X(24)	Name of county in which mine is located.
30	Injury Flag	Pic 9	Company statement that this company had reportable injuries or illnesses during first quarter. 1 if yes; 2 if no.
31-33	Injury Count	Pic 9(3)	Number of reportable accidents and illnesses given on employment form for first quarter.
34-37			Injury flag and injury count for second quarter.
38-41			Injury flag and injury count for third quarter.
42-45			Injury flag and injury count for fourth quarter.
46-47	Filler	Pic XX	Unneeded information.
48-49	Update Addition Year	Pic 99	Year address information was added to file.
50-52	Update Addition Year	Pic 999	Update cycle number address information was added to file.
53-54	Update Change Year	Pic 99	Year of latest change to address information.
55-57	Update Change Year	Pic 999	Update cycle number of latest change to address information.
58	Subunit Operations (number)	Pic 9	Number of subunit operations for this ID.
59-79	Filler	Pic X(21)	Left blank.
80	Card Identifier	Pic 9	Has value 3.

Figure 2. MSHA 80-Column Card Format (continued)

Data Element	Data Field	Data Element
1	1-7	Mine ID
2	8	Status Code
3	9-17	Mine location
	9-12	latitude (DDMM) (D-Degrees, M-Minutes)
	13-17	longitude (DDDMM) (D-Degrees, M-Minutes)
4	18-22	SIC
5	23-29	Size (acres)
6	30-32	percent intact
7	33-38	Entry data
	33-34	number of entries - first type
	35	code for first entry type
	36-37	number of entries - second type
	38	code for second entry type
8	39-41	percent dry
9	42-52	toxic gases (Type gas)
10	53-55	hoist capacity (persons/hr)
11	56-59	percent habitable
12	60-68	number of shelter spaces
13	69-78	additional features
14	79	Blank
15	80	Indicator of continuation record for additional features* (blank = No, * = Yes)

Status Code (Col.8)

0 Under development
1 Active
2 Inactive/Standby
3 Permanently closed
4 Caretaker
5 Intermittent
9 Indicates continuation record

Entry Codes (Cols. 27 & 30)

1 Portal
2 Vertical Shaft
3 Capped (Sealed) Shaft
4 Inclined Shaft
5 Inclined portal
6 Sealed portal
7 Sealed inclined shaft

Note: Blanks are inserted if data are unavailable or not applicable.

*on continuation record, columns 1-7 have mine ID, column 8 has a 9, column 9 is blank, and columns 10-41 have continuation data.

Figure 3. Supplemental Mine Information File Format

1. Mine ID

Mine identification number is a 7-digit number assigned by MSHA to enhance mine identification in computer files and elsewhere. The first two digits of the number identify the state in which the mine is located and the remaining five digits identify the individual mine. Data obtained from BOM did not contain an MSHA compatible ID number for abandoned mines. To make the data for these mines consistent with the data for other mines, RTI developed and assigned ID numbers to abandoned mines using the MSHA system. These numbers were selected so that as new mines are added to the MSHA files, their ID numbers will not duplicate the abandoned mine numbers. This was accomplished by leaving approximately 1,000 unassigned numbers for use in identifying new MSHA mines.

2. Status Code

The status code is a number ranging from 0 through 5 which identifies the status of mining operations at a mine. A mine may be actively mined, may be inactive, which implies that mining operations have ceased but might resume, or may be abandoned, which implies that no future mining operations are anticipated. The cost fluctuation in metal commodities over the past several years has caused frequent and numerous changes in mine status for western metal mines. The demand for limestone, clay, sandstone, and other minerals from underground mines has been much more stable with the result that mining operations in these mines has also been more stable than operations of metal mines.

The MSHA computer file uses 3 codes to identify the status of a mine as active, inactive, or abandoned. Three additional codes are used in the RTI data file to identify a mine as operating intermittantly, as being under

development, or as in a caretaker (inactive) status. These additional status codes help to more accurately reflect the nature and state of mining operations as of spring 1983.

The caretaker status was used by one of the New Mexico MSHA field offices and was added to the data file even though no other sources used this designation. There is undoubtedly some overlap in the use of inactive/standby, caretaker, and intermittant status codes.

Mines classified as inactive fall into a broad category of mines which could abrubtly become active if commodity prices move upward. Some inactive mines employ one or two people to maintain the workings by such activities as pumping water, while other mines are completely inactive but still have the potential of being actively mined.

An abandoned mine is, by definition, one that is sealed or capped. Normally, these mines are never reopened, although on rare occasions, mines classified as abandoned have been brought back into production.

"Under development" is a temporary classification for new mines. The length of time required to bring a mine into production varies considerably from one mine to another depending on such factors as entryway type (shafts or portals), number of entries, wetness, etc. For civil defense purposes, a portal entry mine could provide shelter spaces during development, while a shaft entry mine would be of little use until the extraction of ore or rock is initiated at some level.

Overall, the mine status information is useful and should be helpful to users of the mine data. Mine status can be updated by obtaining the MSHA computer tapes for the most recently available quarter.

3. Location (latitude and longitude)

Latitude and longitude are important data elements to making the mine inventory compatible with the TENOS computer model because the TENOS data base uses a 2-minute by 2-minute grid of the U.S. The MSHA data file did not contain mine longitude and latitude data but the Bureau of Mines file did contain them to the nearest second. Therefore, those few active mines found on both MSHA and BOM files and most abandoned mines in the BOM file had latitude and longitude information reported. For the remaining mines, location coordinates were estimated in various ways. In some cases, the city or town nearest the mine was identified and this information was used to estimate latitude and longitude. In the east and midwest this procedure should give results that are accurate to within a few miles but for western states, which generally have far greater spacing between cities or towns, accuracy is much poorer. To the extent possible, the estimates for western mines were refined through discussions with MSHA field personnel.

Because of the inaccuracy of mine location information, the location of some mines in the inventory (especially western mines) may not be properly identified within their actual 2-minute by 2-minute grid used in the TENOS file. However, the location of all mines is believed to be properly identified within the correct county.

4. SIC Codes

The Standard Industrial Classification (SIC) code for the primary commodity mined at each mine is included on the data record for each mine in the file. This information could provide planners with a qualitative indication of the general usefulness of a mine for civil defense purposes.

In some cases, the SIC code for a mine is uncertain. For example, many small western mines extract silver and gold bearing ores and could properly have the primary commodity mined designated as either gold or silver. In other cases, SIC codes make somewhat artificial distinctions between mining operations. For example, limestone and marble operations are essentially the same since marble is a type of limestone. Therefore, a mine producing crushed and broken marble (SIC-14291) is, for civil defense purposes, the same as one producing crushed and broken limestone (14220). These distinctions do not reduce the usefulness of the information, however.

5. Size (Acres)

Information describing the size of mined out area was requested for each mine in the inventory but was not obtained for all mines. Mine size information was not provided for any mines in Tennessee and for some mines in New Mexico. For many mines in the inventory, MSHA inspectors were able to estimate the mined out area in acres; however, these estimates were not obtained for most western mines. Instead, inspectors for these mines described them as small, medium, or large. These indicators are imprecise and their meanings may vary from one individual to another. In an effort to improve the usefulness of the size information, RTI converted these indicators to a numerical value based on information obtained over the course of the study. The general rules used to estimate metal mine acreages is 1 to 5 acres for a small mine, 10 to 35 acres for a medium mine, and 40 to 200 acres for a large mine. The number entered in the data file is based on these figures and on mine type. For example, among small mines, silver and gold mines were estimated at 1 or 2 acres because most were very small short-lived operations.

Copper mining requires large quantities of ore and the mines tend to be large. Their sizes were estimated toward the upper end of the size ranges.

The size estimates could be in error by a factor of 2 or 3 from the actual mine size; estimates for small mines could be in error by even more. While for individual mines, the potential variation between estimated and actual size is substantial, the differences are reduced when considering summaries of the data such as all mines within a state or region. The BOM data contained information, though frequently dated, on the extent or length of workings for some mines but typically had no indication of actual size. When length of workings was reported, RTI used the reported figure and an assumed average width of all workings of 10 feet to estimate mine floor area.

6. Percent Intact

Intactness refers to the structural soundness of the mined out area of a mine and relates directly to the use of mines as fallout shelters. Intactness is a strong function of the geologic formations that contain the mine. Some mineral formations are extremely strong and remain completely intact for many years, while others, like salt formations, become plastic and cave in after a few years of exposure to the atmosphere. This characteristic could keep the habitable area of salt mines relatively small given a steady rate of extraction. This data element is an estimate of the percentage of mined out area that is structurally sound. The values entered in the file are estimates provided by MSHA personnel.

7. Entry Data

Type of mine entry is of critical importance to a mine's usefulness for civil defense shelter. Consequently, a special effort was made to accurately define the entranceways for each mine in the inventory. Since some

mines were found to have both vertical and horizontal entranceways, the format of the data file was set up to allow two types of entries to be identified. A code to identify the type of entry and the number of each type of entry are contained in the file. The entry codes are listed in Figure 1 and are defined below.

1. portal (adit) - horizontal drift entry that is relatively flat and can be entered by people on foot and/or by ordinary vehicles.
2. Vertical shaft - a vertical opening that houses hoisting equipment for transporting people, equipment, and/or ore.
3. Capped (sealed) shaft - a vertical shaft that has been sealed shut.
4. inclined shaft - a non-vertical opening that houses hoisting equipment.
5. inclined portal - an inclined opening which can be traversed by wheeled vehicles or by people on foot.
6. Sealed portal - a horizontal entry that has been sealed shut.
7. Sealed inclined shaft - an inclined shaft that has been sealed shut.

Aside from differences in terminology used by MSHA personnel, (e.g., adit and portal were used interchangeably) no problems were experienced obtaining entry information. The only inconsistency that may exist in the data is the use of either adit or portal for entries that may in fact be inclined. However, for shelter purposes, the important distinction is between entries that require hoisting equipment to move people and materials and those that can be entered on foot or in vehicles. Entry information in the data file is believed to be very reliable.

In mines that have both portal and shaft entries, portals are used for the passage of heavy equipment and shafts are used for hoisting personnel and ore. If a mine has more than one type of entry, all portions of the mine are generally accessible by either mode of entry.

8. Wetness Data

This data item indicates the percentage of the mine floor area that is sufficiently dry to be habitable. Sufficient water accumulates in most mines to require pumping, although the amount of water that collects is generally relatively small and would not create severe problems for a sheltered population even if pumping were stopped. Because the horizontal working surfaces in underground mines are not level, natural drainage creates wet spots in mines. While the overwhelming majority of mines have some water in them, a few mines, such as salt mines, are absolutely dry.

In some western states, mines may accumulate significant volumes of water during the snowmelt season but have an insignificant amount of water during other times. Mines where this is known to occur have an identifier in item 13 (additional features) of the data file to indicate the situation. Many mines in Colorado, Idaho, Montana, Wyoming, and Washington are likely to have large seasonal variations in water accumulation but it was not possible to quantify such information for inclusion in the data file.

9. Toxic Gases (gas type)

An entry is made in this item to identify any toxic gases present in the mine atmosphere. Methane and radon gases are the most prevalent types of toxic gases found in mines. Methane occurs rarely in noncoal mines and MSHA personnel stated that outside of Colorado, and New Mexico, very few mines have radon or other gas problems. These states plus Utah and Wyoming make up the area where uranium is mined. Radiation levels in uranium and other mines are usually quite low and appear to pose no great health risk for short exposure periods. All uranium mines are listed as having radiation exposure.

During periods of active mining, most underground mines have problems with air quality as a result of blasting. No such problems should develop

under shelter conditions and no indication is made in the data file related to this condition.

10. Hoist Capacity (Persons/hour)

The estimated hoist capacity was entered in this data item in terms of persons per hour that a hoist can transport into a mine. This information is important to assessing potential occupancy limitations that a mine might have as a result of limited hoist capacity.

As stated earlier, hoist information obtained from a recent survey was provided by MSHA's Health and Safety Analysis Center. The survey forms provided information on shaft depth, maximum hoist speed, and hoist usage (i.e., whether men and materials or crushed rock and ore are transported). MSHA estimated that approximately 75 percent of mine hoists are included in the survey. Information was not available for recently developed mines.

All hoists are considered to be available to transport people and supplies into mines during a crisis situation. Hoist capacity was calculated by assuming that each hoist trip is to the bottom of the shaft and that hoist speed is near maximum. These figures were used to compute the time required for each trip and the figure obtained was then rounded to whole minutes. Total trip time was computed by adding one minute at the beginning and end of each trip to allow for loading and unloading people. Since the survey forms did not provide an indication of man cage capacity, it was estimated at 10 people based on discussions with MSHA personnel and on observations during the mine visits discussed in Section A.

An example hoist capacity calculation for a hoist having a maximum speed of 250 feet per minute traveling in a 500-foot shaft would be as follows:

One way trip time = 500ft/250 ft/min = 2 minutes

Total trip time:

1 minute (loading)

+ 2 minutes (down)

+ 1 minute (unloading)

+ 2 minutes (up)

= 6 minutes (total)

At six minutes per trip, the hoist can make 10 trips per hour. If 10 persons are carried into the mine per trip, the calculated hoist capacity would be 100 persons per hour.

11. Percent Habitable

Percent habitable designates the portion of a mine that might be useful as lodging or shelter and was computed using intactness and wetness data. While the most straightforward way to compute the percent habitable is to take the product of percent intact and percent dry, discussions with mine personnel and MSHA inspectors and observations during mine visits convinced RTI that mine areas considered to be wet are not necessarily unusable as shelter. Consequently, estimates of habitable area assume that some parts of wet mines are usable space. If a mine is reported to have 50 percent or more of its area dry, percent habitable is computed as the product of percent intact and percent dry. If a mine is reported to have less than 50 percent of its area dry, percent habitable is computed as the product of percent intact and 0.5. In effect, the assumption is that no more than 50 percent of a mines intact area will be unusuably wet. The basis for the space estimates is an RTI observation that in wet mines, a great deal of effort is devoted to the design and construction of an effective drainage system. A result of these efforts is that substantial portions of such mines are relatively free of standing water and mud and therefore could be used as lodging or shelter area.

It was further observed that in mines that are relatively dry, much less emphasis is given to water drainage. Consequently, wet areas in relatively dry mines are likely to be unusably wet. A figure of 50 percent wet or dry was somewhat qualitatively selected as the border between mines that are considered wet and those that are considered dry.

Using the above procedure, a mine that is reported as 25 percent wet is estimated to have 75 percent of its intact area habitable and a mine that is reported as 75 percent wet is estimated to have 50 percent of its intact area habitable. As an example of the procedure, the Homestake Mine in Lead, South Dakota has 25 percent of its workings intact and is 100 percent wet. Percent habitable is therefore, (.025) x (0.50) = 0.125 or 12.5 percent.

12. Number of Shelter Spaces

This entry contains the estimated number of shelter spaces in a mine. To estimate the number of shelter spaces, RTI used a ratio of 30 square feet of floor area per space which amounts to 1,452 spaces per acre. Estimates for individual mines were made by computing the product of percent habitable, mine size in acres, and 1,452 spaces per acre. The resulting number was entered on the data file.

13. Additional Features

The additional features entry in the mine data file contains information pertaining to any special or unusual features of a mine that affect its usefulness for civil defense purposes. Some typical entries for this item include:

1. identification of multi-level mines,
2. seasonal wetness,

3. abandoned mines that are likely to be flooded,
4. excessive temperatures,
5. special ventilation characteristics, and
6. mining method used.

Such information was identified only for a small percentage of mines but was entered in the data file when available.

Once the MSHA 80-column card data and the supplemental mine information records were both available in mine ID order, the next step in creating a complete mine inventory file was the consolidation of the MSHA and supplemental information files into one. A program was created that successfully accomplishes this consolidation. The result is a mine inventory file containing information for 1,198 underground mines. The record format for the file is given in Figure 4. In the process of creating the mine inventory file, the SIC and status codes on the MSHA data records were updated with those on the supplemental information files, since the latter were based on more recent data. Thus, 21 SIC code and 208 status code changes were made to the MSHA data values in creating the mine inventory file. All data fields for which values were unknown are blank on the mine inventory file. Therefore, for the 181 mines appearing on the supplemental information file that were not on the MSHA file, all the fields normally on the MSHA data, except mine ID, SIC code and status code are blank. Similarly, for one mine (Lockport Plant, Lockport, Kentucky) on the MSHA file for which no supplemental information could be found, the fields that are usually taken from the supplemental information file are blank. The 5-digit SIC codes used on the suplemental information file and appearing on the mine inventory file were chosen from the same list used for the original MSHA file; the list, in numeric order, is giver in Figure 5.

Card 1

Identical to MSHA 80-column card-1 format (see Figure 2), except status code chosen from range of values shown in Figure 3.

Card 2

Identical to MSHA 80-column card-2 format (see Figure 2).

Card 3

Character Positions	Data Element	Picture	Description
1-58			Identical to corresponding columns of MSHA 80-column card-3 format (see Figure 2).
59	Filler	Pic X	Left Blank.
60-63	Latitude	Pic 9(4)	In DDMM format; taken from supplemental mine information file.
64-68	Longitude	Pic 9(5)	In DDDMM format; taken from supplemental mine information file.
69-75	Size	Pic 9(6) V9	In acres, with one place to right of the implied decimal, 6 places to left (e.g., entry "0001000" means 100.0 acres); taken from supplemental mine information file.
76-77	Percent - Intact	Pic 999	Percentage of mine intact; taken from supplemental mine information file.
78-79	Filler	Pic XX	Left Blank.
80	Card Identifier	Pic 9	Has value 3.

Card 4

Character Positions	Data Element	Picture	Description
1-2	Number of entries	Pic 99	Number of entries of first indicated type (code list in Figure 3), taken from supplemental mine information file.
3	Entry type	Pic 9	Code for first entry type; taken from supplemental mine information file.
4-6			Number of entries and code for second indicated entry type; taken from supplemental mine information file.
7-9	Percent-dry	Pic 999	Percentage of intact portion of mine that is dry, taken from supplemental mine information file.
10-20	Toxic Gases	Pic X(11)	List of toxic gases present in mine, delimited by commas and containing the chemical formulas for the substances, except for the notational use of the keywords "none", "radiation" ("rad"), "radon"; taken from supplemental mine information file.

Figure 4. Mine Inventory File Format

Card 4 (continued)

Character Positions	Data Element	Picture	Description
21-23	Hoist capacity	Pic 999	Total capacity, in persons/hour of all hoists in mine; hoists generally found at shaft entries; taken from supplemental mine information file.
24-27	Percent-habitable	Pic 999V9	Percentage of mine habitable as shelter spaces; generally product of percent-intact and percent-dry, but not less than 50 percent of intact area; taken from supplemental mine information file.
28-36	Number of Shelter Spaces	Pic 9(9)	Number of shelter spaces in mine, obtained by product of mine size (in acres), percent-habitable, and 1452 sheltered persons per usuable mine acre; taken from supplemental mine information file.
37-78	Additional features	Pic X(42)	Verbal comments not elsewhere recorded that either explain the other entries further or tell about particular entries or limitations of this mine as shelter; character positions 37-46 are taken from the normal supplemental mine information record, character 47-78 are either blank or taken from character positions 10-41 on the continuation record in the same file.
79	Filler	Pic X	Left Blank.
80	Card Identifier	Pic 9	Has value 4.

Figure 4. Mine Inventory File Format (continued)

10110	Iron Ore
10210	Copper Ore
10310	Lead and/or Zinc Ore
10410	Gold (Lode and Placer)
10440	Silver Ores
10510	Aluminum Ore
10610	Ferroalloy Ores
10611	Chromite
10612	Cobalt
10613	Columbiank - Tantalum
10614	Manganese
10615	Molybdenum
10616	Nickel
10617	Tungsten
10920	Mercury
10940	Uranium - Vanadium Ores
10941	Uranium
10942	Vanadium
10990	Metal Ores, NEC
10991	Antimony
10992	Beryl
10993	Platinum Group
10994	Rare Earths
10995	Tin Ore
10996	titanium
10997	Zircon
11110	Coal, Anthracite
12110	Coal, Bituminous
13111	Oil Shale
14110	Stone, Dimension NEC
14111	Granite (Dimension)
14112	Limestone (Dimension)
14113	Marble
14114	Sandstone (Dimension)
14115	Slate (Dimension)
14116	Traprock (Dimension)
14220	Limestone (Crushed & Broken)
14230	Granite (Crushed & Broken)
14290	Stone, Crushed & Broken, NEC
14291	Marble (Crushed & Broken)
14292	Sandstone (Crushed & Broken)
14293	Slate (Crushed & Broken)
14294	Traprock (Crushed & Broken)
14410	Sand & Gravel
14530	Clay (Fire)
14550	Clay (Common)
14590	Clay, Ceramic & Refrectory, NEC
14591	Aplite
14592	Brucite
14593	Feldspar
14594	Kyanite
14595	Magnesite
14596	Shale (Common)
14720	Barite
14730	Fluorspar
14740	Potash, Soda & Borate Minerals NEC
14741	Boron Minerals
14742	Potash
14743	Trona
14744	Sodium Compounds
14750	Phosphate Rock
14760	Salt (Rock)
14770	Sulfur
14790	Chemical and Fertilizer, NEC
14791	Lithium
14792	Pigment Mineral
14793	Pyrites
14794	Strontium
14920	Gypsum
14960	Talc, Soapstone & Pyrophylite
14990	Nonmetallic Minerals, NEC
14991	Asbestos
14992	Gemstones
14993	Gilsonite
14994	Mica
14995	Peat (before 1979)
14996	Perlite
14997	Pumice
14998	Vermiculite
28190	Industrial Chemicals, NEC
28191	Alumina (Mill)
28193	Bromine
29900	Leonardite
28991	Salt (Evaporated)
28992	Salt (In Brine)
32410	Cement
32740	Lime

Figure 5. SIC Codes Used by MSHA

In order to make the mine inventory information more amenable to an analysis of the adequacy of underground non-coal mines in meeting rapid enhancement shelter needs, a mine sheltering capability report, which presents the post-relocation population and available mine spaces by county was developed. In the report, mine spaces are presented separately for portal entry mines, (i.e., those with entry type codes 1,5, or 6) and other mines. However, the mine inventory records that consisted only of supplementary information did not, at this point, have a FIPS* county code and corresponding name on them. In addition, some of the mine data records in the MSHA file were determined to have an incorrect county designation. A procedure was therefore developed to update the FIPS county codes and associated names on the mine inventory file and, in the process, to supply the FIPS state code where needed. It should be noted that the FIPS state codes are different from the MSHA state codes, which are embedded in the first two digits of the mine ID field; their correspondence is shown in Figure 6. The final mine inventory file, has, on most records, the latitude -longitude and the FIPS state and county codes, which provide a direct link to TENOS.

The other total needed, by county, for the mine sheltering capability report was post-relocation population. This population was found from a summary of the Rapid Enhancement Plan A, 1980 Conglomerate Listing, which contains the estimated 1980 Census population, risk population, allocated population, and ratio of allocated to host populations, by county, for all

---

*FIPS location codes are codes to identify named populated places and related entities of the states of the United States and were developed by the national Bureau of Standards as part of the Federal Information Processing Standards.

State Name	Abbreviation	MSHA Code	FIPS Code
Alabama	AL	01	01
Arizona	AZ	02	04
Arkansas	AR	03	05
California	CA	04	06
Colorado	CO	05	08
Connecticut	CT	06	09
Delaware	DE	07	10
Florida	FL	08	12
Georgia	GA	09	13
Idaho	ID	10	16
Illinois	IL	11	17
Indiana	IN	12	18
Iowa	IA	13	19
Kansas	KS	14	20
Kentucky	KY	15	21
Louisiana	LA	16	22
Maine	ME	17	23
Maryland	MD	18	24
Massachusetts	MA	19	25
Michigan	MI	20	26
Minnesota	MN	21	27
Mississippi	MS	22	28
Missouri	MO	23	29
Montana	MT	24	30
Nebraska	NE	25	31
Nevada	NV	26	32
New Hampshire	NH	27	33
New Jersey	NJ	28	34
New Mexico	NM	29	35
New York	NY	30	36
North Carolina	NC	31	37
North Dakota	ND	32	38
Ohio	OH	33	39
Oklahoma	OK	34	40
Oregon	OR	35	41
Pennsylvania	PA	36	42
Rhode Island	RI	37	44
South Carolina	SC	38	45
South Dakota	SD	39	46
Tennessee	TN	40	47
Texas	TX	41	48
Utah	UT	42	49
Vermont	VT	43	50
Virginia	VA	44	51
Washington	WA	45	53
West Virginia	WV	46	54
Wisconsin	WI	47	55
Wyoming	WY	48	56
District of Columbia	DC	49	11
Alaska	AK	50	02
Hawaii	HI	51	15
Pacific Island Possessions	PP	52	Mult. No's
Panama Canal Zone	CZ	53	61
Puerto Rico	PR	54	72
Virgin Islands	VI	55	78

Figure 6. State Code Table

high-risk areas in the United States, including military installations, basic industries, and population concentrations of 50,000 or more. A given county may appear in one or more conglomerates and may have a risk population, a host population, or both. The summary, across conglomerates by FEMA region and FIPS state and county codes, was created as part of an earlier project; the record format for the resulting file, modified to contain MSHA instead of FIPS state codes, is shown in Figure 7.

The next step in obtaining the mine sheltering capability report was the creation of a report input file containing MSHA state codes, FIPS county codes, post-relocation population by county, and the corresponding drift, other, and total mine shelter spaces. The county post-relocation population was obtained from the sum of the allocated, host, and residual (neither risk nor hosting, but resident) populations from the conglomerate summary file described above. From the report input file, the mine sheltering capability report was produced and is contained in Appendix B. Asterisks in the percentage fields of a mine sheltering capability report line imply that mine shelter spaces are more than 10 times the post-relocation population, or that the post-relocation population is zero, thus preventing percentages from being determined. Counties generally appear in alphabetical order within states; however, in those states, such as New Mexico, that have mine shelter spaces with no county designation, such spaces appear last within their respective state and are labelled "Unknown County."

Character Positions	Data Element	Picture	Description
1-2	Region	Pic 99	FEMA Region Code (not used).
3-4	State	Pic 99	MSHA state code.
5-7	County	Pic 999	FIPS county code.
8-15	Estimated Population	Pic 9(8)	Total 1980 population, estimated from 1970 Census figures (not used).
16-23	Risk Population	Pic 9(8)	Total population at risk (not used).
24-31	Host Population	Pic 9(8)	Total host population.
32-39	Other population	Pic 9(8)	Total residual (neither risk nor host) population.
40-47	Allocated Population	Pic 9(8)	Total population allocated to county for hosting purposes.

Figure 7. Conglomerate Summary File Format.

III. MINE USE EVALUATION

A. Planning Requirements

Effective use of underground mines for civil defense shelters in a crisis situation will require detailed planning. Local civil defense personnel are the most likely candidates for completing these plans because of their ready access to detailed local information.

In evaluating whether to include a mine as a host area shelter in a rapid enhancement plan, several factors must be considered. These factors include the percentage of host area shelter requirements that could be satisfied by the mine or mines, the quality of alternative available shelters, accessibility of the mine site(s), and the habitability of the mine(s).

In some cases, a county contains mines capable of sheltering many times the designated post-relocation population. In such a case, consideration could be given to allocating people from neighboring counties if other factors are favorable. For example, an NSS facility generally would require less advance planning and less habitability upgrading than a mine, and would therefore be preferred in developing a rapid enhancement plan. However, in a county that is expected to be subject to low blast overpressures, the mine might be preferred. If a mine is to be employed as shelter, the site must be accessible, both for the people to be sheltered and for supplies. Parking is a potential problem at some mine sites. Finally, if a large number of people is to be sheltered in a mine, habitability is a primary concern.

Improving the habitability of a mine includes providing food and medical supplies, providing a minimal degree of lighting to prevent people from becoming disoriented, providing sufficient ventilation to maintain the oxygen and carbon dioxide concentrations at acceptable levels, providing potable water for consumption and personal hygiene, and providing for the sanitary

handling and disposal of wastes. The problem of food and medical supply provision is common to all types of shelter, and will not be addressed here. In a previous study (Ref. 1), RTI developed a planning manual for crisis-utilization of mines. In the manual, procedures are described for evaluating and upgrading the lighting, ventilation, water supply, and waste disposal systems in a mine. The following paragraphs summarize the minimum requirements for these services, and the planning and upgrading material requirements to implement each system in a mine.

Only minimal levels of illumination (0.5 to 3.5 lumens per square foot) are required in a mine (Ref. 2). Tasks such as food preparation that require a reasonably high level of light can be performed in the vicinity of a light source. It is unlikely that an active mine will contain a lighting system, though an inactive mine might be lighted if it is being used for another purpose such as storage. From the standpoint of designing a lighting system, underground mines fall into two categories: (1) mines where room and pillar or similar methods have been employed to extract ore, leaving large rooms suitable for use as shelter and, (2) mines where other mining methods (stoping, caving, etc.) have been utilized in which most or all of the habitable floor area is found in the haulage drifts.

The requirements for light bulbs and sockets and for generating capacity are much less in mines with large rooms than in mines with only haulage drifts available for shelter. Table 1 contains requirements for these resources in both types of mines. The requirements for a mine with large rooms were estimated assuming pillars spaced 50 feet on center and 40-watt light bulbs located in alternate rooms. The requirements for a mine in which haulage drifts would be used were derived assuming 8-foot wide drifts and 100-foot spacing of 40-watt light bulbs. In general, lights should be spaced at

Table 1. Primary Resource[a] Requirements to Attain Minimum Habitability Level

Type of Service	Upgrading Resource	Resource Requirement
Lighting	light bulbs and sockets	1 bulb & socket/27 spaces[b] 1 bulb & socket/170 spaces[c]
	generating capacity	40w/27 spaces[b] 40w/170 spaces[c]
Ventilation	generating capacity	1 kw/910 spaces[d]
Water	storage capacity	3.5 gal/space
	watering points	1/50 spaces
	water disinfectant	0.00002 lb chlorine/space
	storage container disinfectant	0.00009 lb chlorine/space
Excreta Disposal	disposal capacity	2.1 gal/space
	toilet seats	1/50 spaces
Solid Waste Disposal	collection capacity	15 gal/50 spaces

[a]Resources that might not be locally available in adequate quantities.

[b]Requirements for a mine with shelter space in haulage drifts. Assumes 40-w light bulbs at 100-ft intervals in 8-ft wide drift.

[c]Requirements for a mine with shelter space in large rooms. Assumes pillars spaced 50 feet on center and 40-w light bulbs located in alternate rooms.

[d]Based on the volume of air delivered by four 5-foot diameter axial fans, driven by 10-horsepower motors, having a rated capacity of 53,000 cfm in free air, installed in a mine in Kansas City.

100-foot intervals. Forty-watt light bulbs will suffice, though larger bulbs could be used if sufficient generating capacity is available.

Regardless of the type of mine involved, an electrical engineer or experienced electrician should be consulted early in the planning process to lay out lighting circuits, prepare specifications, and estimate resource requirements. Arrangements should be made with an electrical contractor(s) to install the lighting system should the rapid enhancement plan be enacted. Also, sources of light bulbs, sockets, and engine-generators as well as fuel; feeder wire; branch lines; hammer drills and carbide-tipped bits; expansion bolts or lead expansion shields; conduit, junction boxes, and pull boxes or messenger cable and insulators; and one working platform (preferably a covered truck or panel truck) per two-man team of electricians must be identified.

Because of the high heat-absorbing capacity of rock, temperature control is not generally required in underground mines. Therefore, the ventilation system only needs the capacity to deliver 3 cfm per occupant, which will maintain the quality of the air at acceptable levels. Most active underground mines contain forced ventilation systems, which in many cases will be adequate to meet the needs of shelter occupants. An existing forced ventilation system can be augmented if necessary. In some cases the quantity of natural ventilation (convection) will be adequate, though this will vary with outside temperature and should be checked at various times throughout the year. If natural ventilation is inadequate, a forced ventilation system with the capacity to satisfy the total ventilation requirement is needed. It is also possible that distribution of ventilation within the mine will need augmentation, particularly if the entrances are close together. This can be accomplished by installing partitions or by using ducts to distribute air to regions of the mine remotely located from openings.

Table 1 lists a generating requirement of 1 kw per 910 shelter spaces. This is based on the volume of air delivered by four 5-foot diameter axial fans, driven by 10-horsepower motors, having a rated capacity of 53,000 cfm in free air, installed in a mine in Kansas City (Ref. 2). The generating requirement will vary with the type of fan used and will be greater if ducts must be used, particularly if the ducts have bends.

In the early stages of planning, a ventilation specialist should be consulted to help evaluate existing ventilation systems and if needed, to plan upgraded system. If upgrading is required, an electrical contractor should be identified to install the fans and engine-generators. In addition, sources of fans, engine-generators, fuel, hand tools, lumber, nails, plastic duct or polyethylene if air distribution is inadequate, should be located.

The Federal Civil Defense Guide (Ref. 3) calls for a minimum of 3.5 gallons of water per shelter occupant. This quantity of water is only enough to satisfy physiological requirements and does not allow for cooking and basic cleanliness. In addition, one watering point per 50 people should be made available.

Most mines contain water that enters from groundwater sources. A health department sanitarian or water works employee should test any existing water for potability and if required, should also assist in identifying methods of augmentation. If insufficient quantities of water are available inside the mine, water storage in cans, barrels, tank trucks, etc. will be needed. Depending on the source of water and method of storage, disinfection may be required. As is shown in Table 1, 0.00002 pounds of chlorine per space is needed to disinfect drinking water and 0.00009 pounds of chlorine per space is needed to disinfect storage containers before filling with potable water. In planning to use a mine as shelter, it is also important to identify sources of

cans, barrels, tank trucks, etc., disinfectants; hand tools; faucets; and plastic pipe if water is to be piped into the mine.

The disposal of human excreta and solid waste in a mine is important in the prevention and control of common vehicle- and vector-borne communicable diseases. Existing waste disposal systems will not be adequate to handle the quantity of wastes that would be generated if a mine were used as shelter. A public health specialist, sanitarian or sanitary engineer should be consulted early in the planning process.

Table 1 displays the primary resource requirement for excreta and solid waste disposal. One toilet seat per 50 spaces and a disposal capacity of 2.1 gallons per space are needed for sewage (Ref. 3). For solid waste collection, one 15-gallon container per 50 spaces should be supplied (Ref. 1). In addition, disinfectants (e.g., chloride of lime), plastic trash can liners, handsprayers, insecticides, rodenticides, hand tools, lumber, plywood, and if incineration is planned, fuel, corrugated iron sheets, and/or wire baskets are required. Planning should include location of sources for all of the above supplies as well as making arrangements for delivery to the mine.

B. Impact Estimates

The 1,198 underground mines incorporated into the mine inventory are located in 217 counties and 24 states. The 1980 conglomerate listing did not include 51 of the 217 counties with mines. This implies that these 51 counties are not considered to be in either a host or risk area in a nuclear attack situation. As can be seen from the listing in Appendix B, the range of estimated mine shelter spaces in the 51 counties with no post-relocation population data is similar to the range for other counties. Because of the potential advantages of mine shelters over other types of shelters, civil defense planners may want to consider modifying existing host area

designations to include some or all of these 51 counties. A decision to make such modifications can only be made after carefully weighing resource availability in existing host counties against those of the alternate counties.

The listing in Appendix B also shows that estimated mine shelter spaces in the 166 counties found in the conglomerate file varies from a fraction of a percent of the post-relocation population to more than 10 times the post-relocation population. If further investigation by local planners shows that the excess spaces are attractive shelters, there may be an incentive to redistribute the relocated population to more fully use these mine spaces. It should be pointed out that there may be additional shelter spaces available in abandoned mines. The county summaries do not give any credit for space in abandoned mines.

There are several aspects of the mine inventory data that must be kept in mind by civil defense planners when considering the use of mine spaces. The estimates of shelter spaces are based on imprecise data and should not be construed to necessarily represent the actual spaces available in mines. Local planners will need to make their own determination of shelter capacity as a part of the planning process. In many mines, the amount of usable floor area and thus the shelter capacity varies substantially with season of the year. Data describing these variations may need to be considered in the planning process. Mining is a dynamic industry in that (1) the status of mining operations at a particular site may change abruptly depending on market conditions, (2) conditions within mines, such as the structural soundness of particular mine areas, may degenerate with time, and (3) the mined out area and thus the potential shelter area in mines constantly changes.

Operability of hoist equipment following a nuclear detonation may not be a certainty. If a mine is located in an area subject to blast effects, hoisting equipment could be damaged and rendered unusable. If a mine is not in an area subject to blast effects, hoisting equipment may not operate because of damage to electric utilities unless emergency generators are available at the mine site. These potentialities should be considered before incorporating shaft-entry mines into shelter plans.

The mine inventory file is available at the FEMA computer facility in Olney, Maryland. The inventory resides on a permanent file called "FEMA*MINES." and may be accessed by that name. Data may be extracted from the file using the format given in Figure 4.

References

1. Wright, M.D., S.B. York,III, D.R. Johnston, and M.N. Laney. Mine Utilization in Crises - Planning Manual. Final Report 44U-982-2. Research Triangle Park, N.C.: Research Triangle Institute. September 1976.

2. Wright, M.D., E. L. Hill, J.S. McKnight, and S.B. York,III. Mine Lighting and Ventilation in Crises. Final Report 43U-982-1. Research Triangle Park, N.C.: Research Triangle Institute. October 1975.

3. Federal Civil Defense Guide, Part D, Chapter 2, Appendix 4, Fallout Shelter Water Requirements, Washington, D.C.: Office of Civil Defense, July 1965.

4. Rajagopalon, S. and M.A. Shiffman. Guide to Simple Sanitary Measures for the Control of Enteric Diseases, Geneva: World Health Organization, 1974.

APPENDIX A:

Listing of Mines in the National Underground Mines Inventory

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
ROCKWOOD MINE	0100010	01	059	29040
	0100100	01	073	
	0100101	01	111	
	0100102	01	125	
MIAMI MINE LEACHING OPERATION	0200139	04	007	90750
SAN MANUEL MINE	0200151	04	021	72600
MAGMA MINE	0200152	04	021	72600
MARCH MINE	0200286	04	003	7260
SAFFORD BRANCH	0200299	04	009	72600
WHITE HILLS G.A.R. SHAFT	0200444	04	015	7260
LAKESHORE MINE	0200498	04	021	72600
MIAMI EAST-SHAFT 5	0200825	04	007	18150
ORACLE RIDGE	0200840	04	019	18150
EL DORADO MINE	0200951	04	007	14520
BIG SKY MINING	0201118	04	003	7260
CHRISTMAS UG MINE	0201319	04	007	7260
TWIN BUTTES \TWIN BUTTES =1 AD	0201565	04	019	7260
BRICK MINE	0201575	04	023	7260
COPPER QUEEN BRANCH	0201656	04	003	72600
STATE OF MAINE MINE	0201737	04	003	2904
DRY HILLS MINE	0201760	04	003	
DOME VENTURE MINE	0201950	04	027	2904
SOLSTICE NO 1	0201951	04	003	2904
THE INDEPENDENCE & AUNT SALLEY	0201959	04	003	2904
HULDA	0201969	04	015	2904
HACKS CANYON 2	0201973	04	015	36300
SACATON SHAFTS	0201979	04	021	0
LEAD BULLET	0201987	04	015	0
COMPENSATION MINE	0201993	04	011	0
NICHOLAS	0202001	04	003	2904
HEL-ROC MINE & MILL	0202027	04	019	7260
SUNCHIEF MINE	0202031	04	007	2904
ASH PEAK	0202033	04	011	7260
GOLDBERG	0202044	04	021	7260
HACKS CANYON 1	0202058	04	015	0
DIPLOMAT	0202065	04	015	2904
EDITH SHAFT	0202066	04	025	2904
RED CLOUD MINE	0202067	04	027	2904
V & M MINE	0202068	04	021	2904
ACQUISITION MINE	0202069	04	025	2904
GOLDEN RULE MINE	0202070	04	003	2904
DAVIS DUNKIRK	0202073	04	025	2904
TAKO MINE	0202077	04	003	2904
PIDGEON	0202084	04	005	0
POLLY ANN	0202087	04	011	2904
GOLDEN GEM	0202089	04	015	2904
SUMMIT	0202090	04	015	2904
SUN MINE	0202092	04	003	2904
GRAND CENTRAL MINE	0202093	04	003	2904
MATCH BOX MINE	0202094	04	025	2904
APACHE MINE	0202097	04	003	2904
	0204000	04	007	
	0204001	04	007	

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
	0204002	04	007	
	0204003	04	007	
	0204004	04	015	
	0204005	04	023	
	0204006	04	023	
	0206001	04	000	
	0206002	04	000	
	0206003	04	000	
ARKANSAS LIMESTONE OPERATION	0300051	05	065	261360
GUION MINE AND MILL	0300313	05	065	254100
EL DORADO LIMESTONE CO	0400104	06	017	7260
SAN LEANDRO QUARRY	0400242	06	001	7260
SIDE HILL	0400581	06	027	7260
ORIENTAL	0400898	06	091	4356
PINE CREEK MINE	0400899	06	027	81675
ECLIPSE MINE	0401098	06	027	7260
YUCCA PIT	0401107	06	071	3267
KATE HARDY OMEGA MINES	0401285	06	091	2904
HAZARD MINE	0402441	06	061	2904
BEN HUR MINE	0402456	06	073	2904
ALHAMBRA-ATLANTA GOLD MINE	0402459	06	017	2904
LAWS MILL & MINE	0402653	06	027	2904
GRANTHAM MINE	0402656	06	027	4356
PLUMBAGO MINE	0403065	06	091	2904
RUBY MINE	0403108	06	091	2904
STRAWBERRY MINE	0403143	06	039	2904
BROWN BEAR MINE	0403206	06	105	2904
UPPER BRUSH CREEK	0403309	06	091	2904
WASHINGTON MINE & MILL	0403425	06	089	2904
OLD NOBLE MINE	0403708	06	073	0
COLORADO QUARTZ	0403828	06	043	2904
BLUE LEAD MINE	0403859	06	057	2904
CHEROKEE MINE	0404004	06	007	2904
TRAIL CLAIM	0404046	06	017	2904
EL DORADO - PLUMBAGO MINES CON	0404070	06	091	2904
BILLIE MINE	0404218	06	027	145200
GOLDEN CROWN	0404234	06	091	2904
BLAZING STAR	0404242	06	009	2904
GOLDEN LION	0404259	06	091	2904
BLUE LEDGE MINE	0404283	06	017	2904
MILLER MINE	0404295	06	009	29040
EMPIRE QUARTZ MINE	0404307	06	091	2904
SOLWOODS MINE	0404309	06	091	2904
MORNING GLORY MINE	0404311	06	091	2904
MINNIE #D# MINE	0404312	06	091	2904
OCEOLA MINE	0404313	06	091	2904
WHISKEY CREEK =1	0404317	06	091	2904
GLEN OLIVE MINE	0404318	06	029	2904
IRELAN	0404319	06	091	2904
ARCADE MINE	0404321	06	091	2904
OROFLAME QUARTZ MINE	0404322	06	091	2904
LONG DAVE	0404344	06	111	2904
CRESTMORE MINE	0404347	06	065	21780

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
REX MONTIS MINE	0404366	06	027	2904
SHINING DAWN	0404370	06	071	2904
SENECA PROPRTIES	0404373	06	063	2904
THE LARKIN-STORY HAZZARD MINE	0404374	06	063	2904
EAGLES NEST MINE	0404379	06	065	2904
MORNING STAR MINE	0404380	06	071	2904
SAGAMORE MINE	0404381	06	071	2904
KELLY MINE	0404385	06	105	2904
KEYSTONE MINE	0404390	06	027	2904
HOP DEMONSTRATION UNITS = 1,2,	0404394	06	029	0
IRON TAIL MINE	0404403	06	091	2904
FOUR HILLS MINE	0404406	06	091	2904
GOLD POINT MINE	0404413	06	091	0
IRON DOOR	0404415	06	091	2904
CRYSTAL DAWN =1	0404432	06	007	0
JEREMIAH-RANDELL =1	0404433	06	007	2904
HARPY =1	0404434	06	007	2904
PENON BLANCO MINE	0404436	06	043	0
GOLD RUN MINE	0404438	06	061	
ZACA ALPINE	0404444	06	003	2904
MERZ MINE	0404453	06	061	2904
FRAZIER MINE	0404454	06	111	2904
O K WEST =1	0404456	06	071	2904
GREAT NORTHERN	0404457	06	071	2904
REID MINE	0404458	06	089	2904
BULLY CHOOP	0404459	06	105	2904
GLOBE MINE	0404460	06	105	2904
HILTON CREEK MINE	0404461	06	051	0
FLUME HOUSE MINE	0404466	06	009	2904
GRAND PRIZE	0404481	06	005	
STEWART LETHIA MINE	0404486	06	073	2904
BLACKSTONE MINE	0404488	06	009	2904
SOLEDAD EAST	0404489	06	029	2904
BONDURANT	0404491	06	043	0
MISSION MINE	0404501	06	065	2904
EL ORO MINE	0404510	06	057	2904
WYOMING MINE	0404512	06	027	2904
BEAUREGARD	0404513	06	051	2904
BUTTE LODE	0404518	06	029	2904
MODOC GROUP MINING PROPERTIES	0404519	06	027	2904
MAY LUNDY	0404520	06	051	2904
WHITE BEAR MINE	0404522	06	091	2904
WOODHOUSE MINE	0404523	06	009	2904
PRINCETON LANDS	0404527	06	043	
M-JON =1	0404529	06	007	
GARRISON'S CRATER =2	0404530	06	007	
GOLDBUG	0404531	06	027	
OMEGA MINE	0404536	06	109	2904
MINNIEHAHA MINE	0404540	06	007	2904
GOLDSTRIPE PROJECT	0404543	06	063	2904
GRIZZLEY PEAK MINE	0404547	06	091	
STORM KING I II III IV V	0404552	06	071	2904
ANGELS NO. I II III IV	0404554	06	071	2904

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
BEN JUAN I II III	0404555	06	071	2904
HI-GRADE MINE	0404557	06	037	2904
REWARD-BROWN MONSTER	0404558	06	027	2904
GOLD SUGAR-COLD BEEF MINE	0404562	06	073	2904
D B MINE	0404567	06	073	2904
MCLAUGHLIN	0404568	06	055	
SILVER CROSS	0404570	06	029	2904
MUZZLE LOADER	0404571	06	073	2904
BUENA VISTA MINE	0404572	06	009	2904
GOLDEN CHARIOT MINE	0404576	06	073	2904
ROUND VALLEY MINE	0404581	06	027	2904
FOUR SQUARE	0404582	06	071	2904
OPTIMIST MINING CO	0404584	06	109	
POKA DOT 1	0404587	06	029	2904
	0406000	06	015	
	0406001	06	019	
	0406002	06	025	
	0406004	06	027	
	0406005	06	027	
	0406006	06	061	
	0406007	06	063	
	0406008	06	085	
	0406009	06	085	
	0406010	06	089	
	0406011	06	093	
ROCK CREEK	0500187	08	101	2904
LARIAT MINE	0500223	08	059	4356
CLIMAX MOLYBDENUM MINE UG	0500354	08	065	58080
MT EMMONS PROJECT	0500409	08	051	1742
EAGLE MINE	0500411	08	037	163350
EMPERIUS	0500412	08	079	30492
BULLDOG MTN. OPERATION	0500413	08	079	581
IDARADO MINE	0500414	08	091	32670
RICO ARGENTINE	0500416	08	033	2033
SUNNYSIDE MINE	0500417	08	111	36300
CAMP BIRD MINE	0500437	08	091	7805
LEADVILLE UNIT	0500516	08	065	21780
CONTINENTAL CHIEF	0500534	08	065	5808
SMITH MINE	0500539	08	047	1089
LONDON MINE	0500571	08	093	3630
CARTER-RAYMOND MINES	0500575	08	051	1997
MAMMOTH REVENUE MINE	0500579	08	021	2904
SHERMAN MINE	0500604	08	065	27225
HOCK HOCKING MINE	0500622	08	093	4356
FRANKLIN 73	0500630	08	019	1452
HENDERSON MINE	0500790	08	019	54450
SCHWARTZWALDER MINE	0500791	08	059	29040
DUGGAN ADIT	0500891	08	085	8712
LOST DUTCHMAN	0500909	08	077	2904
NEW VERDE	0500916	08	077	2904
OCTOBER ADIT	0500918	08	077	2904
SUNBEAM	0501065	08	085	2904
CARNATION	0501106	08	113	2904

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
MESA #5 (CG-27)	0501117	08	077	2904
ANDREW'S MINING CO	0501159	08	085	2904
ST PATRICK NO 7	0501179	08	085	2904
SUNDAY	0501197	08	113	2033
SEPTEMBER MORN	0501278	08	085	2904
PEACHES	0501304	08	077	2904
THORNTON	0501311	08	085	8712
HENRIETTA MINE	0501382	08	111	2904
COUCH PLACER & CHAFFEE MINE	0501390	08	047	726
GOLDEN WONDER	0501506	08	053	2178
SILVER TIPMINE	0501527	08	049	1452
RESURRETION NO 2 SHAFT	0501603	08	065	726
URA	0501653	08	085	2904
NIL	0501658	08	085	2904
SUNCUP NO 2	0501679	08	113	2904
TWILIGHT #1/SFCL STUDIES SEC	0501714	08	085	2904
EULA BELLE	0501740	08	085	1452
MIDNIGHT MINE	0501754	08	103	2904
RAJAH 49	0501761	08	077	2904
RAJAH 30	0501765	08	077	2904
RIM ROCK #2	0501780	08	085	2904
DEREMO-SNYDER	0501786	08	113	34558
PACK RAT	0501793	08	077	8712
RED BIRD	0501806	08	085	2904
BURRO MINE	0501819	08	113	6897
COLONY SHALE OIL PROJECT	0501887	08	045	1452
REX 38	0502013	08	085	2904
BROMIDE MINE	0502039	08	081	2904
LOGAN WASH OIL SHALE	0502248	08	045	2904
CLIMAX TEN MILE TUNNEL	0502255	08	117	0
AJAX-CRESSON MINE & MILL	0502266	08	119	2178
CLUB MINES	0502338	08	085	2904
MONOGRAM MINES	0502340	08	085	2904
BALD EAGLE MINE	0502354	08	019	726
LONG PARK 15	0502379	08	085	2904
GEO #1 MINE	0502383	08	085	2904
BESSIE G MINE	0502387	08	067	2904
PAYSTREAK	0502397	08	113	2904
BUENO MILL	0502402	08	013	363
ANVIL POINTS MINE & PLANT	0502500	08	103	2904
SYRACUSE	0502501	08	051	1997
ALL STARS	0502512	08	085	2904
BUFFALO BOY	0502610	08	051	1997
LETTY JONES	0502671	08	113	2904
KING SOLOMON MINE	0502675	08	085	8712
GRACE	0502706	08	085	5808
GOOD FRIDAY MINE	0502720	08	013	2904
DIXIE GOLD & SILVER MINING LTD	0502724	08	019	1452
CROSS MINE	0502730	08	013	1452
VEGA MINE	0502765	08	117	3630
C-SR-13-A #VETA MAD#	0502771	08	113	2904
MAMMOTH MINES NO 114 & 423	0502774	08	047	1634
C-SR-13	0502786	08	113	2904

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
PEANUT NO 2	0502787	08	085	3485
IKE C SR 11	0502789	08	113	2904
)	0502803	08	019	0
MARY NEVIN MINE	0502815	08	119	36300
CREEDE VENTURE	0502905	08	079	58080
C-JD6	0502912	08	033	2904
PARIS MINE	0502918	08	093	1452
C-LP-21	0502921	08	085	2904
GOLDBELT TUNNELS MINE AND MILL	0502934	08	019	726
SUN DOG MINE	0502935	08	019	1452
HUBBARD MINE	0502940	08	077	2904
BROOKLYN MINE	0502944	08	111	2033
CENTENNIAL	0502993	08	113	2904
MINERAL CHANNEL 12	0502994	08	077	2904
DONALD L	0502996	08	085	2904
C-LP-22 MINE	0503011	08	085	2904
C-JD-7	0503031	08	085	2904
U S B M NO. 1 SHAFT	0503046	08	103	726
FELIX MENDICCO	0503052	08	085	0
ANNA MAY	0503053	08	085	2904
STANLEY MINE	0503054	08	019	1452
C-J-D-9	0503066	08	085	2904
ROSEBUD MINE	0503073	08	077	2904
LITTLE MAUDE	0503081	08	111	2904
GOLCONDA	0503083	08	053	2904
ANGLO SAXON =2	0503091	08	111	2904
RISORGIMENTO	0503103	08	053	1452
TRACT C-A	0503131	08	103	1452
CATHEDRAL BLUFFS	0503140	08	103	
PARACHUTE CREEK	0503143	08	045	32670
C B SHALE OIL LEASE	0503148	08	103	
C-B TRACT	0503149	08	103	3485
S M 18 MINE	0503152	08	085	2904
ST JUDE MINE	0503153	08	113	2904
FEDERAL OIL SHALE LEASE-TRACT	0503179	08	103	0
RIO BLANCO OIL SHALE PRO	0503181	08	103	0
MATCHLESS MINE	0503184	08	077	0
C-LP 22A	0503195	08	085	2904
RUBY TRUST MINE	0503208	08	091	2323
G3/CG27	0503209	08	077	2904
BREEZY MINE	0503211	08	085	2904
EQUINOX	0503225	08	085	2904
ELLISON MINE	0503241	08	113	2904
JIM DANDY MINE	0503249	08	093	
BONZO	0503257	08	059	
AMETHYST QUEEN	0503263	08	077	2904
FEDERAL OIL SHALE LEASE, TRACT	0503280	08	103	0
MOFFAT TUNNEL	0503299	08	119	7260
ALFA CORSAIR ADIT	0503307	08	079	1452
C SR-10	0503415	08	113	2904
EGBERT/ZEBRA	0503417	08	085	2904
OSCEOLA-PRIDE MINE	0503428	08	111	
KING NO 2	0503433	08	113	2904

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
BLACK ROSE MINE	0503460	08	005	1452
RAMEY MINE	0503461	08	013	1452
RIFE	0503462	08	005	726
C-BL-23B	0503465	08	085	2904
EZRA R	0503467	08	111	2904
CASHIN MINE	0503474	08	085	2323
BEVERLY SHAFT MINE	0503481	08	105	1452
MORNING STAR	0503487	08	093	1089
ELK PARK MINE	0503500	08	111	2904
JULIANS MINE	0503501	08	085	2904
ROSEBUD	0503503	08	033	2904
TUNGSTEN	0503524	08	013	1452
REVENUE VIRGINIUS MINE	0503528	08	091	4646
CLAY COUNTY MINE	0503530	08	047	1089
BLACK JACK SU	0503546	08	113	2904
VOLCANO MINE	0503555	08	119	1452
CENTENNIAL MINE	0503557	08	019	1452
SCHOOL SECTION MINE	0503559	08	119	1452
GOLD CREST	0503561	08	117	1452
MIDLAND MINE	0503564	08	051	1452
RED POINT MINE	0503566	08	045	0
POMPEII MINE	0503568	08	119	1452
GLADIATOR-GEN SHERMAN	0503576	08	053	2323
NEVADA MINE	0503583	08	109	1452
COMSTOCK-LAKE MINES	0503585	08	019	1452
MOOSE MINE	0503594	08	093	1452
COLUMBINE TUNNEL	0503596	08	013	1452
CARIBOU MINE	0503599	08	013	3630
MOUNTAIN TOP MINE	0503602	08	091	2904
MOBIL EXPERIMENTAL MINE	0503603	08	045	0
EMMA MINE	0503605	08	033	3485
HARVEY ADIT	0503607	08	077	2904
ST KEVIN	0503609	08	065	0
TOPAZ	0503613	08	113	2904
HAMILL MINE	0503614	08	019	1452
CHAMPION-TRIO MINE	0503615	08	019	0
SENATOR-BLUE RIDGE MINE	0503616	08	019	0
POORMANMINE	0503617	08	019	0
PHOENIX MINE	0503618	08	019	0
BRAZIL MINE	0503619	08	019	0
HOT POT MINE	0503620	08	019	0
BRIGHTON MINE	0503621	08	019	0
WHEATLAND	0503625	08	019	726
AURUM	0503634	08	013	726
FRONTENAC MINE	0503652	08	047	726
TOGO MINE	0503653	08	047	1452
NEW YORK MINE	0503655	08	117	1452
FAIR CHANCE MINE	0503657	08	119	2178
CRAZY GIRL	0503664	08	019	1452
JUMBO MINE	0503665	08	019	1452
MAY DAY MINE	0503674	08	067	2904
NATIONAL MINE	0503675	08	047	1452
CUMBERLAND	0503678	08	067	2904

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
TREASURE MOUNTAIN	0503680	08	111	2904
SILVER LINK	0503681	08	091	2904
SUMMITVILLE PROJECT\EXPLORATIO	0503684	08	105	1452
INTERNATIONAL	0503688	08	119	1452
COD \REBECCA'	0503689	08	119	1452
FREDA CLAIM	0503693	08	111	2904
IRON CLAD MINE	0503695	08	119	1452
WYOMING MINE	0503701	08	037	1452
YELLOW PINE	0503703	08	013	1452
MOOSE MINE	0503706	08	047	1452
MARY MURPHY MINE	0503711	08	015	1452
READY CASH MINE	0503712	08	065	1452
RAINBOW GROUP	0503715	08	093	1452
OLD SETTLER MINE & MILL	0503716	08	019	1452
OUT WEST MINE	0503721	08	083	2904
CONCORD MINERALS CORPORATION M	0503724	08	019	1452
PEACOCK LODE MINING	0503725	08	119	1452
SHAUN LODE	0503728	08	027	1452
LOGOS I	0503729	08	047	1452
NABOB MINE	0503734	08	019	2178
OLD HUNDRED MINE	0503736	08	111	2904
SULTAN MOUNTAIN MINE	0503740	08	111	2904
FAY/TNT =4	0503743	08	085	2904
SILVER GEM	0503745	08	093	2178
PEERLESS	0503746	08	093	2178
INDEPENDENT TUNNEL	0503747	08	019	2178
BABY FAWN	0503750	08	085	2904
WOOD MOUNTAIN GROUP\WMH&NCCT'	0503752	08	013	2178
AORTA TUNNEL	0503763	08	019	1452
BAY STATE TUNNEL	0503764	08	019	1452
HENDERSON NO 5 SHAFT	0503766	08	019	10890
RESURRECTION TUNNEL	0503770	08	079	2904
GROUND HOG	0503773	08	037	2323
	0505000	08	013	
	0505001	08	013	
	0505002	08	015	
	0505003	08	019	
	0505004	08	037	
	0505005	08	041	
	0505006	08	057	
	0505007	08	057	
	0505008	08	065	
	0505009	08	065	
MINE NO 1	0900027	13	123	23232
NEW YORK MINE & MILL	0900030	13	227	43560
MINE NO 6 & MILL NO 5	0900031	13	227	29040
MINE NO 4	0900047	13	227	26136
MILL NO 1 \U.G. LIMESTONE'	0900323	13	123	0
MINE NO 2	0900324	13	123	17424
ROCK CLIFF MINE - UNDERGROUND	0900458	13	213	1271
MINE NO 3	0900877	13	227	2904
GALENA	1000082	16	079	232320
BUNKER HILL MINE	1000083	16	079	232320

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
CRESCENT	1000085	16	079	58080
STAR MORNING	1000086	16	079	34848
LUCKY FRIDAY	1000088	16	079	232320
SUNSHINE MINE & ML	1000089	16	079	232320
SILVER BUTTE MINE	1000138	16	017	2904
CLAYTON GROUP	1000142	16	037	1452
CONSOLIDATED SILVER PROJECT	1000158	16	079	54450
STAR MINE =1 MAIN VEIN	1000189	16	079	
NABOB MINE & MILL	1000194	16	079	2904
IMA MINE	1000224	16	059	
CALADAY PROJECT	1000409	16	079	0
CONJECTURE MINE	1000411	16	017	36300
GOLDEN CHEST MINE	1000414	16	079	2904
DEMOCRAT MINE	1000467	16	059	
COEUR MINE	1000479	16	079	72600
BAILEY LEASE	1000487	16	079	
BLACKBIRD MINE	1000533	16	059	14520
GOLDEN GATE TUNGSTEN	1000672	16	085	
LITTLE MOOSE MINE	1000678	16	049	
MISSOURI MINE	1000774	16	015	
SOUTH MOUNTAIN MINE	1000866	16	073	2904
CEDAR MOUNTAIN MINE	1000869	16	055	2904
RESCUE MINE	1000877	16	049	2904
OZARK EXTENSION	1000993	16	049	2904
FOUR SQUARE MINE & MILL	1001004	16	079	2904
KRAKEN HILL MINE	1001025	16	037	2178
GOLDEN EAGLE MINE	1001116	16	049	2904
NEW HOPE MINE	1001223	16	013	0
I D K MINE	1001237	16	049	2904
BUCHER BAR MINE	1001258	16	049	2904
KING OF THE WEST	1001261	16	025	
BANNER MINE	1001302	16	015	
SIX MILE MINE	1001310	16	049	2904
HAYSTACK MINE	1001311	16	049	2904
GOLDBACK MINE	1001317	16	079	2904
LOST CABIN	1001334	16	079	2904
ROYAL APEX MINE	1001344	16	079	2904
GREYHOUND MINE	1001352	16	037	0
MAJESTIC SILVER & LEAD MINE	1001364	16	079	2904
SILVER BAR MINE	1001391	16	015	0
WARRIOR MINE	1001404	16	049	2904
SEVEN GRAND MINING OPERATION	1001413	16	049	2904
DOUBLE DIAMOND HITCH =1	1001414	16	049	2904
IRON MASK MINE	1001415	16	017	2904
ABELLA	1001416	16	015	
LONE PINE MINE	1001421	16	049	2904
KIMBERLEY MINE	1001423	16	049	2904
HUMBOLDT MINE	1001424	16	049	2904
EL ORO MINE	1001440	16	039	
WHISTLER TUNNEL	1001443	16	079	2904
IDAHO LAKEVIEW MINE	1001453	16	017	2904
SHAMROCK MINE	1001461	16	055	2904
LOST PACKER MINE	1001469	16	037	2904

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
MASTER MINE #1	1001489	16	055	2904
MAJESTIC MINE	1001493	16	049	2904
BOYD MINE	1001497	16	025	2904
BIG EDDY MINE	1001503	16	079	
CAMP PROJECT	1001506	16	079	
CHUCKAR MINE	1001511	16	073	
COLUMBIA MINE	1001515	16	013	
FIDDLE CREEK DRIFT PLACER	1001516	16	049	2904
SILVER STRIKE MINE	1001517	16	013	0
SUNSET MINE	1001522	16	015	
CANYON CREEK MINE	1001526	16	049	2904
GILMORE MINE	1001527	16	059	4356
CENTER STAR GOLD MINE	1001534	16	049	2904
HERCULES MINE	1001538	16	039	
SEAFOAM MINE	1001546	16	037	
RED HORSE MINE	1001549	16	025	2904
MILL QUARTZ	1001556	16	049	2904
ESTES MOUNTAIN MINES	1001558	16	037	726
CHARLES DICKENS	1001559	16	037	1815
BALTIMORE MINE	1001569	16	039	
	1002000	16	003	
	1002001	16	037	
	1002002	16	037	
	1002003	16	059	
	1002004	16	059	
	1002005	16	079	
	1002006	16	079	
	1002007	16	085	
QUARRY - 1	1100019	17	001	145200
CHESTER QUARRY COMPANY	1100031	17	157	72600
VALMEYER #3 QUARRY & MILL	1100036	17	133	726000
ALTON MINE	1100122	17	119	290400
STOTZ QUARRY INC.	1100213	17	157	60113
MINERVA MINE NO. 1	1100791	17	069	145200
BARNETT COMPLEX MINE	1101599	17	151	2904
H M SHAFT	1101603	17	069	32670
QUARRY - 3	1101707	17	001	101640
SPIVEY MINE	1101764	17	069	1815
BIRK NO. 2A	1102598	17	003	3485
MOAD MINES	1102608	17	003	5808
THORNTON UNDERGROUND MINE NO.	1102619	17	031	7260
DENTON	1102667	17	069	1452
ELMHURST UNDERGROUND NO. 1	1102707	17	043	14520
HENSON	1102713	17	151	5445
	1103000	17	069	
MARENGO MINE & MILL	1200047	18	025	217800
UNITED STATES GYPSUM CO	1200427	18	101	290400
SHOALS MINE	1200429	18	101	290400
LAPEL MINE AND MILL	1201038	18	095	40656
DERBY UNDERGROUND MINE	1201397	18	123	18513
DERBY SLOPE MINE	1201423	18	123	363
ECKERTY UNDERGROUND MINE	1201713	18	025	21780
INDIANA CAL-PRO INC.	1201757	18	105	2904

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
KENTUCKY AVENUE MINE & MILL	1201762	18	097	3049
AMES MINE	1300014	19	169	21780
DOUDS UNDERGROUND MINE	1300018	19	177	217800
FT DODGE MINE	1300032	19	187	29040
LINWOOD MINE & MILL	1300097	19	163	196020
MALCOM STONE CO MINE	1300112	19	157	83490
COLUMBUS JUNCTION UNDERGROUND	1300194	19	115	39204
YOUNG AMERICA MINE & MILL	1300197	19	183	39204
SPERRY MINE	1300434	19	057	261360
CLAYTON PLANT	1300615	19	043	58080
MOBERLY QUARRY	1300862	19	079	32670
DURHAM MINE	1301225	19	125	29040
WEBER MINE AND MILL	1301262	19	105	29040
RAYMOND MINE	1301760	19	013	5808
FERGUSON MINE	1301924	19	127	2904
WATERLOO SOUTH MINE	1301926	19	013	290400
BROMLEY MINE & MILL	1400061	20	005	145200
THOMPSON-STRAUSS QUARRIES	1400159	20	209	108900
VANLERBERG QY - UG	1400161	20	091	290400
HOLLAND MINE & MILL =1	1400172	20	091	116160
SUN CITY MINE	1400308	20	007	145200
BLUE RAPIDS MINE & MILL	1400309	20	117	163350
INDEPENDENT SALT CO	1400411	20	053	217800
CAREY ROCK SALT MINE	1400412	20	155	165528
AMERICAN SALT MINE & MILL	1400413	20	159	191664
MIDLAND QUARRY MINE	1400606	20	005	14520
HOLLAND MINE =2	1400761	20	091	0
LORING MINE	1401282	20	103	21780
TOBIN MINE & MILL	1401323	20	091	12705
TOBIN MINE & MILL =2	1401398	20	091	0
	1401600	20	099	
MARION PLANT	1500003	21	055	
BOONESBORO QUARRY, INCORPORATED	1500006	21	151	
CAMP NELSON STONE CO, INC.	1500010	21	079	1307
CASEY STONE COMPANY	1500012	21	045	
CEDAR BLUFF MINE UNDERGROUND	1500013	21	033	
LEXINGTON UNDERGROUND NO.1	1500016	21	067	3086
TIPTON RIDGE QUARRY	1500019	21	065	
GLENNS CREEK	1500020	21	073	3086
TYRONE U G MINE	1500043	21	005	
YELLOW ROCK MINE AND MILL	1500048	21	129	2360
MOUNT VERNON MINE & MILL	1500051	21	203	
CRESTWOOD MINE UG	1500059	21	185	
M J M MINE AND MILL	1500061	21	175	
PENDLETON COUNTY UNDERGROUND	1500062	21	191	174240
RIVERSIDE STONE MINE UG	1500081	21	163	
RAGLAND MINE & MILL	1500086	21	085	
RICHMOND ROAD QUARRY	1500107	21	067	3086
OKOLONA QUARRY	1500108	21	111	436
INDIAN CREEK UNDERGROUND	1500111	21	109	
CLOVER BOTTOM UNDERGROUND	1500112	21	109	
MILL CREEK STONE	1500195	21	237	1997
LOCKPORT PLANT	1504479	21	103	

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
LEXINGTON QUARRY COMPANY	1506264	21	113	4646
CABIN CREEK MINE	1507101	21	161	76230
	1508000	21	055	
	1508001	21	055	
	1508002	21	057	
	1508003	21	139	
	1508004	21	139	
	1508005	21	139	
	1508006	21	139	
	1508007	21	171	
WEEKS ISLAND STORAGE COMPLEX	1600239	22	045	0
BELLE ISLE	1600246	22	101	52272
COTE BLANCH MINE	1600358	22	101	52272
JEFFERSON ISLAND PLANT	1600506	22	045	0
AVERY ISLAND MINE AND REFINERY	1600509	22	045	65340
WEEKS ISLAND MINE AND MILL	1600512	22	045	0
WEEKS ISLAND MINE & MILL	1600970	22	045	62073
	1602000	22	051	
	1602001	22	075	
	1602002	22	109	
=5 MINE	1700246	23	021	726
	1700500	23	009	
	1700501	23	029	
BROWNINGS DEEP CREEK MINE	1800037	24	023	14520
SOUTH MINE MILL	1800342	24	005	14520
	1800500	24	023	7260
WHITE PINE COPPER DIVISION	2000371	26	131	36300
DETROIT MINE	2000552	26	163	54450
KENTWOOD MINE	2001019	26	081	7260
ROPES GOLD MINE	2002574	26	103	1452
	2005000	26	053	2904
	2005001	26	071	
	2005002	26	053	
ADRIAN MATERIALS MINE	2300001	29	019	1452
ALROK MINE & MILL	2300007	29	095	290400
NORTH CAVE MINE AND MILL	2300028	29	097	50820
CALLAWAY MINE & MILL	2300032	29	095	0
PLANT =1 UG MINE & MILL	2300094	29	077	72600
CARTHAGE MINE & MILL	2300112	29	097	26136
RUSH TOWER MN & ML	2300130	29	099	11616
KELLY MINE & MILL	2300143	29	103	13068
RANDOLPH MINE	2300154	29	047	726000
ROCK ACRES QUARRY UNDERGROUND	2300182	29	095	65340
PIXLEY MINE & PLANT	2300201	29	095	290400
SOUTHWEST LIME CO	2300202	29	145	36300
LEE'S SUMMIT QY \U G'	2300215	29	095	0
WEILER MARBLE MINE	2300227	29	186	17424
FLETCHER	2300409	29	179	130680
PEA RIDGE MINE	2300454	29	221	145200
MAGMONT MINE AND MILL	2300456	29	093	145200
BUICK MINE	2300457	29	093	217800
FRANK R. MILLIKEN MINE & MILL	2300458	29	179	217800
VIBURNUM NO 28 MINE & MILL	2300494	29	093	130680

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
VIBURNUM NO. 29 MINE	2300495	29	093	0
INDIAN CREEK MINE	2300497	29	221	0
BRUSHY CREEK	2300499	29	179	145200
PEERLESS MINE	2300542	29	186	696960
UNIMIN MINE AND MILL	2300786	29	099	435600
NORTHWEST MINE & MILL	2300924	29	015	50820
ASH GROVE MINE & MILL	2301007	29	077	58080
PACIFIC WORKS, UNDERGROUND MIL	2301061	29	189	29040
OSAGE MINE & MILL	2301174	29	029	50820
BURLINGTON MINE	2301605	29	173	21780
MADISON MINE	2301770	29	123	72600
WEST FORK	2301787	29	179	0
VIBURNUM =35 MINE	2301800	29	093	0
CENTRAL STONE ST. LOUIS DIV.	2301828	29	189	17424
TABLE ROCK QUARRY =1 UNDERGROU	2301836	29	213	8712
	2302500	29	017	
	2302501	29	189	
SHOEMAKER	2400145	30	027	72600
WARM SPRINGS MINE	2400146	30	077	72600
BABBITT MINE	2400174	30	089	19602
VALLEY VIEW MINE	2400241	30	057	1452
FLATHEAD	2400284	30	047	0
MOULTON MINE	2400448	30	013	1452
SPOTTED HORSE MINE, INC.	2400512	30	027	1452
SILVER BUTTE	2400551	30	053	1452
POLARIS MINE	2400686	30	001	1452
KELLY MN COMPLEX VARIOUS MNS	2400710	30	093	
STAR MINE	2400748	30	013	2904
SILVER KING MINE	2400942	30	039	2904
LOTTA TUNNEL	2401055	30	043	1452
DRUMLUMMON MINE	2401079	30	049	2904
ELKHORN MINE	2401140	30	001	2904
JARDINE MINE	2401145	30	067	
BLACK PINE MINE	2401147	30	039	40874
EAST PACIFIC MINE	2401221	30	007	1452
ALAMEDA	2401256	30	057	2904
GOLDEN JUBILLE	2401358	30	039	2904
BLUE BIRD MINE	2401423	30	053	0
NELLIE GRANT	2401441	30	043	0
TROY PROJECT	2401467	30	053	76230
STILLWATER PROJECT	2401490	30	095	2904
MOHAWK MINE	2401492	30	067	
HALEY MINE	2401493	30	049	
LIBERTY MINE	2401516	30	045	
B AND H MINE	2401519	30	057	1452
IRON MASK MINE	2401529	30	007	1452
GOLDEN DAWN MINE	2401535	30	001	2904
SPOKANE HILL MINE	2401540	30	007	
BUCKEYE MINES	2401541	30	057	0
HOPE MINES	2401549	30	039	1452
GENERAL CUSTER	2401550	30	007	1452
MATTIE V	2401560	30	063	0
STILLWATER PGM RESOURCES MINE	2401562	30	097	

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
MATLETON MINE	2401581	30	057	0
GREY JOCKEY MINE	2401587	30	001	218
GRUBSTAKE MINE & MILL	2401588	30	057	0
CANNIVAN GULCH PROJECT	2401590	30	001	0
GOLD CROWN	2401591	30	049	2904
GOLDEN ANCHOR	2401602	30	077	726
CHAR TAM	2401604	30	007	
JOE DANDY	2401605	30	007	1452
JAY GOULD MINE	2401606	30	049	0
ELK CREEK MINE	2401607	30	063	2904
SPUHLER MINE & MILL	2401617	30	057	
LOTTIE MINE	2401629	30	057	
DOROTHY #1	2401630	30	057	726
RIDGEWAY MINE	2401631	30	057	2904
FRENCH CREEK MINE	2401632	30	001	
GOLDEN AGE	2401634	30	043	
NICK AND DICK MINE	2401635	30	049	1452
LILLY MINE	2401636	30	007	
BROADWAY VICTORY	2401639	30	057	
BEAL MINE	2401642	30	093	0
GOLD BUG	2401649	30	061	0
GRUBSTAKE MINE CLAIM	2401651	30	089	726
TABOR NO. 1	2401653	30	057	2904
NEVER SWEAT	2401655	30	057	2904
ELKHORN MINE	2401657	30	043	
TABOR NO. 2 - MILLIE BLY	2401658	30	057	2904
TABOR NO. 3 - NEW WINNETHA	2401659	30	057	2904
TABOR NO. 4 - KEYHOLE	2401660	30	057	2904
TABOR NO. 5 - ST. JOHN	2401661	30	057	2904
SILVER RIDGE	2401662	30	001	2904
BI METALLIC	2401664	30	043	0
BELMONT	2401665	30	049	
MONTREAL MINE	2401667	30	093	2904
	2401706	30	057	2904
	2402000	30	049	
	2402001	30	049	
	2402002	30	077	
	2402003	30	077	
	2402004	30	077	
	2402005	30	089	
	2402006	30	095	
	2402007	30	097	
WEEPING WATER MINE AND MILL	2500017	31	025	580800
WEEPING WATER MINE AND MILL	2500020	31	025	29040
TEXASGULF INC	2500554	31	025	145200
WEEPING WATER NORTH MINE	2500934	31	025	21780
WEEPING WATER SOUTH MINE	2500998	31	025	0
NEW DISCOVERY	2600052	32	023	1452
CROWELL FLUORSPAR MINE	2600091	32	023	1452
MAKIE PERLITE MINE	2600117	32	017	1452
BAY STATE	2600209	32	033	1452
GOOSEBERRY MINE	2600249	32	029	1452
EMERSON MINE	2600340	32	017	29040

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
TYBO MINE	2600513	32	023	1452
THOMAS W	2600561	32	015	1452
WARD	2600576	32	033	10164
BARCELONA	2600597	32	023	0
NEVADA SCHEELITE	2600614	32	021	1452
INDEPENDENCE	2600826	32	015	1452
SUTTON II	2600964	32	027	1452
WELLS TUNGSTEN MINE	2600985	32	007	1452
NELLIE GRAY MINE	2601136	32	023	1452
CASELTON MINE	2601146	32	017	29040
LITTLE JUPITER MINE	2601260	32	027	1452
VICTORIA UNIT	2601317	32	007	1452
TEMPIUTE METALS CO MINE	2601436	32	017	1452
VIVIAN TUNNEL	2601498	32	007	1452
STERLING MINE	2601503	32	023	1452
NEW SAVAGE MINE	2601522	32	029	1452
DIAMOND MINE	2601524	32	011	1452
HILLSIDE	2601533	32	015	1452
TRUE BLUE	2601553	32	015	1452
GREY EAGLE MINE	2601575	32	015	1452
IDA MINE	2601587	32	019	1452
MOHO MINE	2601593	32	021	1452
TONOPAH EXTENSION	2601604	32	023	0
MINERVA MINE	2601605	32	033	1452
BIG COMSTOCK MINE	2601608	32	029	1452
CHALLENGE	2601614	32	021	1452
FALCON	2601628	32	007	1452
KLONDIKE	2601632	32	015	1452
ESMERALDA	2601633	32	007	1452
16 TO 1 MINE	2601638	32	009	29040
ADELAIDE MINE	2601647	32	013	0
FENCEMAKER	2601650	32	027	1452
SILVER CONNOR	2601656	32	011	1452
MOHAWK MINE	2601662	32	005	1452
INDIAN QUEEN	2601669	32	021	1452
POTOSI	2601684	32	021	1452
BUCKSKIN OPERATIONS	2601685	32	005	1452
BELL MINE	2601689	32	021	1452
RIDDLE	2601702	32	007	1452
RAND MINE	2601703	32	003	1452
MAYBERRY MINE	2601707	32	023	1452
SOUTH COMSTOCK MINE	2601711	32	019	1452
J P MINE	2601715	32	033	1452
LUCKY BOY MINE	2601719	32	021	1452
MARY MINE	2601722	32	009	1452
NEW YORK SHAFT	2601727	32	015	1452
TRANSVALL MINE	2601731	32	023	1452
MAYFLOWER MINE	2601732	32	023	1452
LITTLE SUMMIT	2601747	32	021	1452
ARGUS	2601750	32	021	0
LIVE YANKEE	2601754	32	021	1452
SANGER MINE	2601755	32	009	1452
TRAMP MINE	2601756	32	023	1452

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
RAVEN MINE	2601767	32	013	1452
JUNIATA \AKA CHESCO'	2601770	32	021	1452
MOHAWK II MINE	2601773	32	009	0
EAGLE TUNGSTEN MINE	2601785	32	021	1452
GEORGENE	2601788	32	021	1452
	2602500	32	001	
	2602501	32	007	
	2602502	32	013	
	2602503	32	013	
	2602504	32	013	
	2602505	32	013	
	2602506	32	013	
	2602507	32	015	
	2602508	32	017	
	2602509	32	017	
	2602510	32	021	
	2602511	32	021	
	2602512	32	023	
	2602513	32	023	
	2602514	32	023	
	2602515	32	027	
	2602516	32	027	
	2602517	32	027	
	2602518	32	033	
	2602519	32	033	
	2602520	32	033	
STERLING MINE & MILL	2800393	34	037	49005
GROUND HOG UNIT	2900157	35	017	
NASH DRAW	2900166	35	015	18150
HOBBS POTASH FACILITY	2900170	35	015	108900
PCA MINE AND MILL	2900173	35	015	145200
AMAX MINE AND MILL	2900174	35	015	108900
MISSISSIPPI CHEMICAL CORPORATI	2900175	35	015	36300
CONTINENTAL UNDERGROUND COMPLE	2900233	35	017	36300
OLD BECK	2900268	35	023	
HUMMINGBIRD	2900270	35	049	5445
SAN PEDRO MINE	2900294	35	049	2904
SEC 24 14N 10W	2900537	35	031	
SEC 30 14N 9W & 29 1	2900538	35	031	
SEC 30 WEST	2900539	35	031	
SECTION 33	2900541	35	031	
SEC 35 MINE	2900542	35	031	
SEC 36 - UG	2900543	35	031	
JOHNNY M SHAFT	2900560	35	031	
L-BAR URANIUM OPERATIONS	2900565	35	061	78408
ANN LEE	2900569	35	031	
NORTHEAST CHURCHROCK MINE	2900573	35	031	
SANDSTONE MINE	2900575	35	031	
SECTION 27	2900579	35	031	
SEC. 23	2900590	35	031	
SEC. 25 MINE	2900591	35	031	
SEC. 29 & 32	2900593	35	031	
ENOS JOHNSON	2900602	35	045	

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
CENTER SHAFTS	2900752	35	017	3630
LINCHBURG MINE	2900757	35	053	
MILL GEN SHOPS OFF WORK	2900776	35	031	
SEC 17 14N 9W	2900778	35	031	
SECTION 19	2900781	35	031	
CHURCHROCK NO. 1	2900782	35	031	
IMC CARLSBAD	2900802	35	015	127050
LEA MINE AND REFINERY	2901147	35	025	90750
P-10	2901214	35	061	
QUESTA MINE	2901267	35	055	43560
RUBY NO. 1 & 2	2901364	35	031	
MT. TAYLOR	2901375	35	061	0
MARQUEZ SHAFT	2901597	35	031	6534
MARIANO LAKE MINE	2901598	35	031	0
SECTION 13 MINE	2901606	35	031	
	2901637	35	000	1815
SECTION 12	2901683	35	031	
NOSE ROCK MINE NO. 1	2901688	35	003	
OLD CHURCHROCK MINE	2901726	35	031	
TODILTO MINE =2 PIEDRA TRISTE	2901729	35	031	
NOSE ROCK NO. 2 MINE \SECTION	2901730	35	031	
SECTION 10 MINE	2901743	35	031	
SECTION 14 MINE	2901744	35	031	
RUBY NO. 3 AND NO. 4 MINE	2901766	35	031	
GREAT REPUBLIC	2901770	35	051	5808
CHURCHROCK NO. 1 EAST	2901775	35	031	
EAST CAMP	2901776	35	017	5445
MARJERY MINE	2901777	35	051	6534
GOLD KING-IMPERIAL	2901778	35	017	3267
CROWNPOINT SECTION 24	2901790	35	031	
MINA AMIGOS MINING COMPANY	2901802	35	017	5445
LEE MINE	2901831	35	031	
WHITE OAKS	2901836	35	027	
BLACK HAWK	2901839	35	051	5445
SILVER CONTACT =8	2901840	35	027	6534
LITTLE GRANITE	2901844	35	051	4356
WASTE ISOLATION PILOT PLANT \W	2901857	35	015	0
P-13 MINE	2901862	35	061	0
NJ-45 MINE	2901863	35	061	0
HERMOSA	2901866	35	051	5445
ST. CLOUD MINE	2901869	35	051	52272
BLACK HAWK MINE	2901877	35	017	4356
	2901999	35	015	43560
	2902000	35	015	
	2902001	35	015	
	2902002	35	017	
	2902003	35	017	
	2907004	35	017	
	2907005	35	029	
	2907006	35	029	
	2907007	35	029	
	2907008	35	043	
	2907009	35	051	

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
	2907010	35	051	
	2907011	35	053	
BALMAT NO. 2 MINE	3000591	36	089	54450
OAKFIELD MINE	3000593	36	037	108900
NO. 1 MINE AND NO. 1 MILL	3000611	36	089	72600
WILLSBORO WALLASTONITE MINE &	3000644	36	031	72600
RETSOF MINE UG	3000662	36	051	4864200
CARGILL SALT CAYUGA	3000663	36	109	726000
BALMAT MINE NO 3	3001184	36	089	54450
BALMAT MINE NO 4 AND MILL	3001185	36	089	54450
HYATT PROPERTY	3001688	36	089	79860
WIGHT MINE	3002236	36	089	29040
NO 4 MINE AND NO 3 MILL	3002245	36	049	29040
PIERREPONT PROPERTY	3002577	36	089	3630
	3003000	36	089	
CRANBERRY MINE & MILL	3100209	37	011	
NANCY JORDAN NO. 5	3100222	37	039	
	3100400	37	099	
	3100401	37	181	
JONATHAN MINE	3300047	39	119	1452000
IRONDALE	3300484	39	081	145200
THE STONE CREEK BRICK CO.MINE	3300563	39	157	1307
	3301349	39	153	1452000
MORTON SALT FAIRPORT MINE	3301993	39	085	1452000
CLEVELAND MINE	3301994	39	035	1306800
	3302000	39	000	1452000
NEW TECH NO. 1	3303897	39	115	1452
ARKHOLA MILL	3400003	40	021	0
MARBLE CITY OPERATIONS	3400282	40	135	108900
BALD MOUNTAIN MINE	3500387	41	001	2904
ARGONAUT MINE	3500670	41	001	1452
COUGAR MINE	3502386	41	023	1452
BLACK BEAR MN & ML	3502537	41	033	
RUTH MINE AND MILL	3502692	41	047	
GREENBACK MINE	3502806	41	033	1452
IRON DYKE MINE	3502868	41	001	2178
YELLOWHORN	3502971	41	033	2904
CRACKER CREEK	3503010	41	001	16335
GOLDEN STAR MINE	3503033	41	039	
CORNUCOPIA MINE	3503038	41	001	1452
IBEX MINE	3503039	41	023	2178
ROBERT EMMETT MINE	3503071	41	001	1452
CHAMPION MINE	3503076	41	039	1452
RAINBOW MINE	3503080	41	033	726
AZURITE MINE	3503084	41	025	1452
QUICKSILVER FALLS =1	3503091	41	005	1452
KAYLOR MINE =3 & PLANT	3600033	42	005	72600
PECK FARM UG	3600124	42	111	14520
BLUE STONE UG QUARRY & MILL	3600131	42	129	72600
	3600155	42	051	1452
BELLEFONTE MINE AND MILL	3600183	42	027	36300
PLEASANT GAP MINE	3600238	42	027	10890
BELL MINE AND BELLEFONTE MILL	3600263	42	027	36300

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
WINFIELD LIME & STONE MINE AND	3600274	42	019	7260
CONTINENTAL CLAY PRODUCTS CO.	3600406	42	005	43560
DREXEL MINE & MILL	3600609	42	005	3630
HANLEY #4A MINE & MILL	3600630	42	065	27225
FRIEDENSVILLE MINE & MILL	3602627	42	077	145200
THOMASVILLE MINE 2 AND 3	3603432	42	133	72600
UG MINE & MILL	3604403	42	005	7260
LAKE LYNN LABORATORY	3606929	42	051	29040
	3608000	42	019	
	3608001	42	007	
	3608002	42	019	
	3608003	42	005	
	3608004	42	000	
	3608005	42	007	
	3608006	42	005	
	3608007	42	011	0
	3608008	42	071	
HOMESTAKE MINE	3900055	46	081	90750
GILT EDGE MINE	3900902	46	081	3630
JUNIPER MINE	3901241	46	103	0
SPOKANE	3901275	46	033	
BOSCOBELL-DOUBLE STANDARD	3901279	46	081	3920
BOB INGERSOLL MINE	3901280	46	103	0
	3901500	46	033	
THETA PIKE MINE	4000020	47	119	98010
ANDERSON PLANT	4000022	47	051	72600
CRAB ORCHARD MINE	4000087	47	035	
JEFFERSON CITY MINE	4000137	47	089	
COY MINE	4000166	47	089	
YOUNG MINE	4000168	47	089	
IMMEL MINE	4000170	47	093	
NEW MARKET MINE	4000606	47	089	
JEFFERSON CITY ZINC UNDERGROUN	4000607	47	089	
CHEROKEE MINE	4000704	47	139	
CALLOWAY MINE	4000707	47	139	
BOYD MINE	4000708	47	139	
ELMWOOD-GORDONSVILLE MINE	4000864	47	159	
BEAVER CK MINE	4001751	47	009	
LUTTRELL UNDERGROUND MINE	4002113	47	173	36300
CARTHAGE ZINC MINE	4002213	47	159	0
NO.3 UNDERGROUND MINE	4002772	47	173	21780
	4003000	47	049	
	4003001	47	057	
	4003002	47	067	
	4003003	47	073	
	4003004	47	139	
	4003005	47	159	
	4003006	47	169	
	4003007	47	169	
	4003008	47	189	
CALCIUM CARBONATE DIVISION J.M	4100055	48	053	54450
VAN HORN WHITE MARBLE MINE	4100995	48	109	21780
GRAND SALINE OPERATIONS	4101776	48	467	58080

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
HOCKLEY MINE	4102478	48	201	29040
BONANZA MINE & MILL	4102782	48	229	14520
SHAFTER MINE	4102905	48	377	7260
	4104000	48	043	
	4104001	48	157	
	4104002	48	377	
LIME	4200003	49	049	4356
TRIXIE	4200147	49	049	29040
ONTARIO MINE	4200150	49	043	29040
LOST SHEEP MINE	4200158	49	023	0
DEER TRAIL MINE	4200260	49	031	2904
HAPPY JACK MINE	4200273	49	037	108900
REDMOND CLAY & SALT MINE & MIL	4200297	49	041	2904
PANDORA	4200470	49	037	108900
RIM	4200472	49	037	108900
WILSON SILVERBELL MINE	4200473	49	037	108900
MI AMORCITA MINE	4200481	49	037	2904
SNOW SHAFT	4200503	49	015	108900
WOOD MINE	4200507	49	037	2904
FARMERS KNOB	4200577	49	017	2904
THORNBURG MEMORIAL	4200624	49	019	108900
SHINARUMP	4200626	49	019	29040
FIREFLY MINE	4200647	49	037	14520
VANADIUM QUEEN MINE	4200648	49	037	29040
LISBON MINE	4200677	49	037	54450
CROWN POINT MINE	4200761	49	049	0
LASAL MINE	4200769	49	037	87120
MARKEY	4200784	49	037	14520
BONANZA MILL	4200854	49	047	14520
B-38 SHAFT	4200862	49	047	14520
LITTLE BONANZA MILL	4200876	49	047	14520
SNOWBALL MINE	4201068	49	037	108900
HARRISON NO. 1	4201146	49	047	14520
LUCKY STRIKE MINE	4201150	49	017	29040
CARR FORK OPERATIONS	4201153	49	045	54450
RELIEF MINE	4201159	49	049	0
CALLIHAM MINE	4201164	49	037	2904
SAGE	4201194	49	037	2904
MINERALS WEST INC	4201196	49	037	2904
BONANZA NO. 8-A	4201200	49	047	14520
SAHARA MINE	4201249	49	015	2904
SPRING LAKE TUNNEL	4201264	49	049	0
JOHN MINE	4201341	49	019	2904
PATTI ANN MINE	4201348	49	037	0
MAMMOTH MINE	4201349	49	023	0
POLAR MESA	4201376	49	019	14520
NORTH ORE SHOOT EXTENSION PROJ	4201392	49	035	0
STRAWBERRY MINE	4201404	49	037	2904
PROBE MINE	4201422	49	015	54450
SOUTH HECLA MINE	4201424	49	035	1452
VIPONT MINE	4201430	49	003	2904
BI-CENTENNIAL	4201438	49	019	58080
DUNN MINE	4201443	49	037	2904

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
INDEPENDENT =4 SHAFT	4201446	49	041	14520
BLUE CAP MINE	4201453	49	037	0
PINE RIDGE NO. 2	4201468	49	037	0
BLACK GNAT MINE	4201500	49	047	14520
VELVET MINE	4201527	49	037	108900
LITTLE EVA MINE	4201533	49	019	2904
FRISCO MINE	4201540	49	037	2904
B-I GONAWAY MINE	4201547	49	037	1452
HECLA SHAFT	4201568	49	037	29040
STRAIGHT CREEK MINE	4201608	49	017	1452
ESCALANTE SILVER MINE	4201613	49	021	29040
THE CUB MINE	4201623	49	037	2904
GRAY DAWN MINE	4201635	49	037	1815
SINBAD	4201676	49	015	2904
SKINNY MINE	4201679	49	019	2904
LASAL NUMBER 2 MINE	4201689	49	019	363
ORO DEL REY	4201690	49	023	2904
JOKER	4201699	49	037	2904
BUFFALO MINE	4201705	49	045	2904
LITTLE JOE MINE	4201708	49	057	0
CHIEF NO. 2	4201709	49	023	2904
LITTLE EMMA = 7	4201712	49	047	14520
BONANZA =12	4201716	49	049	14520
BURGIN MINE APEX NO. 2 SHAFT	4201719	49	049	0
S AND S MINING COMPANY	4201722	49	035	363
OPHIR MINE	4201732	49	021	0
REDROCK MINE	4201741	49	037	29040
IRON BLOSSOM MINE	4201742	49	049	1452
INDEPENDENT NO. 5 SHAFT	4201743	49	047	14520
WILD HORSE MINE	4201744	49	047	11616
LEONORA NO. 1	4201766	49	001	0
COTTONWOOD NO. 1	4201770	49	047	11616
SAMSON NO. 2	4201772	49	047	10164
HARRISON NO. 10	4201773	49	047	11616
B-42 SHAFT	4201774	49	047	8712
WAGONHOUND MINE	4201775	49	047	8712
LITTLE EMMA =5	4201776	49	047	8712
	4202500	49	001	
	4202501	49	001	
	4202502	49	001	
	4202503	49	009	
	4202504	49	035	
	4202505	49	035	
	4202506	49	035	
	4202507	49	045	
	4202508	49	045	
	4202509	49	045	
	4202510	49	047	
	4202511	49	049	
IMPERIAL MINE QUARRY	4300042	50	021	145200
ENGELHARD MIN & CHEM	4300078	50	015	54450
WINDHAM MINE	4300079	50	025	18150
HAMMONDSVILLE MINE	4300080	50	027	54450

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
LUDLOW MINES - UNDERGROUND	4300181	50	027	14520
KIMBALLTON MINE	4400040	51	071	29040
KIMBALLTON MINE AND MILL	4400082	51	071	29040
COVE MINE	4401926	51	173	14520
	4402100	51	005	
	4402101	51	173	
	4402102	51	197	
	4402103	51	009	
	4402103	51	169	
	4402500	51	009	
	4402501	51	109	
REPUBLIC UNIT	4500365	53	019	72600
PEND OREILLE MINE AND MILL	4500366	53	051	54450
WASH ZINC UNIT	4502040	53	065	2904
MOUNT TOLMAN PROJECT	4502169	53	019	0
GOLDEN VALLEY	4502358	53	019	2904
TWISP VIEW MINE =1	4502655	53	047	2904
DAMON MINE	4502843	53	033	2904
M D O I =1 MINE & MILL	4502867	53	007	2904
DEER TRAIL	4502914	53	065	34848
BARITE QUEENE	4502926	53	065	2904
ORAZADA MINE	4502931	53	065	2904
#B# REEF MINE	4502961	53	007	2904
LUCKY BREAK MINE	4502963	53	059	2904
	4503000	53	037	
	4503001	53	061	
	4503002	53	065	
AGGRE MN & PLT	4600009	54	083	36300
GREER MINE AND MILL	4600016	54	061	217800
DECKERS CREEK MINE AND MILL	4600029	54	061	72600
GLOBE MINE = 1	4600148	54	029	87120
MINE NO 1 & PLANT	4601563	54	077	108900
NO. 6 MINE AND GRINDING PLANT	4603363	54	025	7260
	4605000	54	033	
BAY CITY SILICA	4701146	55	093	2904
	4702000	55	000	
SUNRISE MINE & MILL	4800144	56	031	27225
INORGANIC CHEM DIV WESTVACO	4800152	56	037	39204
BIG ISLAND MN & REF	4800154	56	037	39204
ALCHEM MINE	4800155	56	037	39204
WYOMING SODA ASH OPERATIONS	4800639	56	037	39204
BILL SMITH	4800837	56	009	1452
LUCKY MC MINE UNDERGROUND	4800855	56	013	2904
BUFFALO SHAFT	4800946	56	009	0
SHEEP MOUNTAIN OPERATIONS	4800969	56	013	36300
GOLDEN EAGLE MINE	4801051	56	009	36300
NORTH TISDALE GRAVITY DRAINAGE	4801147	56	019	0
FEDERAL-AMERICAN PARTNERS UNDE	4801179	56	013	27225
TENNECO SODA ASH PROJECT	4801295	56	037	39204
MINERAL HILL MINE AND MILL	4801322	56	011	0
BIG EAGLE UNDERGROUND MINE	4801330	56	013	25410
LISBON MINE	4801356	56	003	1452
SHIRLEY BASIN UNDERGROUND NO.	4801368	56	007	1452

MINE NAME	MINE-ID	STATE	COUNTY	SHELTER SPACES
	4802000	56	023	
MIKADO MINE & MILL	5000362	02	185	1452
RYAN LODE	5000365	02	090	0
	5000421	02	201	2178
	5001230	02	999	3630
FERN MINE	5001306	02	090	1452
INDEPENDENCE MINE	5001309	02	170	
GOLD STANDARD MINE	5001311	02	999	2904
GRANT MINE & MILL	5001314	02	185	2904
CLEARY ADIT	5001396	02	090	1452
SUMMIT MINE	5001401	02	185	2904
LITTLE SQUAW MINE	5001402	02	185	1452
ALASKA APOLLO MINE	5001421	02	010	1452
	5001423	02	999	1452
	5001425	02	999	1452
	5002000	02	185	
	5002002	02	090	
	5002003	02	170	
	5002004	02	122	
	5002005	02	231	
	5002006	02	231	
	5002007	02	231	
	5002008	02	110	
	5002009	02	231	
	5002010	02	110	
	5002011	02	220	
	5002012	02	280	
	5002013	02	130	
	5002014	02	201	
	5002015	02	130	
	5002016	02	130	
	5002017	02	050	

APPENDIX B:

Mine Sheltering Capability Report

MINE SHELTERING CAPABILITY REPORT

STATE	COUNTY	DRIFT MINE SPACES	OTHER MINE SPACES	POST-RELOCATION POPULATION	PERCENTAGE SHELTERED IN DRIFT MINE SPACES	PERCENTAGE SHELTERED IN OTHER MINE SPACES
ALABAMA	FRANKLIN	29040	0	53363	54.4	.0
ARIZONA	COCHISE	79860	72600	296847	26.9	24.5
ARIZONA	GILA	21780	116160	167768	13.0	69.2
ARIZONA	GRAHAM	0	72600	85837	.0	84.6
ARIZONA	GREENLEE	7260	7260	53091	13.7	13.7
ARIZONA	MOHAVE	72600	0	223643	32.5	.0
ARIZONA	PIMA	25410	7260	67576	37.6	10.7
ARIZONA	PINAL	87120	163350	288743	30.2	56.6
ARIZONA	SANTA CRUZ	0	7260	96545	.0	7.5
ARIZONA	YAVAPAI	21780	7260	210341	10.4	3.5
ARIZONA	YUMA	14520	0	81261	17.9	.0
ARKANSAS	IZARD	515460	0	10812	*****	.0
CALIFORNIA	ALAMEDA	7260	0	681509	1.1	.0
CALIFORNIA	BUTTE	6712	2904	332734	2.6	.9
CALIFORNIA	CALAVERAS	11616	29040	35724	32.5	81.3
CALIFORNIA	EL DORADO	15972	0	188417	8.5	.0
CALIFORNIA	INYO	31944	234135	91423	34.9	256.1
CALIFORNIA	KERN	11616	2904	676404	1.7	.4
CALIFORNIA	LOS ANGELES	2904	0	314782	.9	.0
CALIFORNIA	MADERA	0	2904	188462	.0	1.5
CALIFORNIA	MARIPOSA	2904	0	41853	6.9	.0
CALIFORNIA	MONO	5808	0	63576	9.1	.0
CALIFORNIA	NEVADA	5808	0	105257	5.5	.0
CALIFORNIA	PLACER	2904	0	160761	1.8	.0
CALIFORNIA	PLUMAS	8712	0		*****	*****
CALIFORNIA	RIVERSIDE	27588	0	1846644	1.5	.0
CALIFORNIA	SAN BERNARDINO	23595	0	839813	2.8	.0
CALIFORNIA	SAN DIEGO	17424	0	2130178	.8	.0
CALIFORNIA	SHASTA	2904	0	330513	.9	.0
CALIFORNIA	SIERRA	40656	21780	9370	433.9	232.4
CALIFORNIA	TRINITY	5808	0		*****	*****
CALIFORNIA	TUOLUMNE	2904	0	111169	2.6	.0
CALIFORNIA	VENTURA	2904	0	890364	.3	.0
COLORADO	ARAPAHOE	0	1815	8463	.0	21.4
COLORADO	BOULDER	6171	10890	175664	3.5	6.2
COLORADO	CHAFFEE	1452	0	40116	3.6	.0
COLORADO	CLEAR CREEK	21054	69696	20889	100.8	333.6
COLORADO	CONEJOS	2904	0	26739	10.9	.0
COLORADO	CUSTER	1452	0	3944	36.8	.0
COLORADO	DOLORES	11324	0	6361	178.0	.0
COLORADO	EAGLE	3775	163350	54737	6.9	298.4
COLORADO	GARFIELD	38478	0	84995	45.3	.0
COLORADO	GILPIN	5445	5626	9536	57.1	59.0
COLORADO	GRAND	1452	0	38181	3.8	.0
COLORADO	GUNNISON	9182	0	40658	22.6	.0
COLORADO	HINSDALE	9438	0		*****	*****
COLORADO	JEFFERSON	4356	29040	151357	2.9	19.2
COLORADO	LAKE	56265	58806	33424	168.3	175.9
COLORADO	LA PLATA	8712	0	85184	10.2	.0
COLORADO	MESA	43560	2904	245510	17.7	1.2
COLORADO	MINERAL	94017	0	1994	*****	.0
COLORADO	MOFFAT	2904	0	42478	6.8	.0
COLORADO	MONTEZUMA	2904	0	61693	4.7	.0
COLORADO	MONTROSE	123419	2904	77948	158.3	3.7
COLORADO	OURAY	53251	0	7096	750.4	.0
COLORADO	PARK	14157	3630	25467	55.6	14.3
COLORADO	PUEBLO	2904	0	23222	12.5	.0

MINE SHELTERING CAPABILITY REPORT

STATE	COUNTY	DRIFT MINE SPACES	OTHER MINE SPACES	POST-RELOCATION POPULATION	PERCENTAGE SHELTERED IN DRIFT MINE SPACES	PERCENTAGE SHELTERED IN OTHER MINE SPACES
COLORADO	RIO BLANCO	5808	5952	22937	25.3	25.9
COLORADO	RIO GRANDE	1452	1452	34064	4.3	4.3
COLORADO	SAGUACHE	1452	0	8164	17.8	.0
COLORADO	SAN JUAN	64468	0	3015	*****	.0
COLORADO	SAN MIGUEL	50457	34485	8219	613.9	419.6
COLORADO	SUMMIT	1452	5082	46901	3.1	10.8
COLORADO	TELLER	17424	39204	34457	50.6	113.8
GEORGIA	GILMER	41019	0	57535	71.3	.0
GEORGIA	MURRAY	1270	0	67555	1.9	.0
GEORGIA	PICKENS	101640	0	59362	171.2	.0
IDAHO	BONNER	45012	0	51874	86.8	.0
IDAHO	CAMAS	5808	0		*****	*****
IDAHO	CUSTER	10164	0		*****	*****
IDAHO	IDAHO	46464	5808		*****	*****
IDAHO	KOOTENAI	8712	0		*****	*****
IDAHO	LEMHI	18876	0		*****	*****
IDAHO	OWYHEE	2904	0		*****	*****
IDAHO	SHOSHONE	23232	1148895	34333	67.7	*****
ILLINOIS	ADAMS	246840	0		*****	*****
ILLINOIS	ALEXANDER	9292	0		*****	*****
ILLINOIS	COOK	7260	0	108440	6.7	.0
ILLINOIS	DU PAGE	14520	0	168187	8.6	.0
ILLINOIS	HARDIN	0	180774		*****	*****
ILLINOIS	MADISON	290400	0	21270	*****	.0
ILLINOIS	MONROE	726000	0	6017	*****	.0
ILLINOIS	POPE	0	9075		*****	*****
ILLINOIS	RANDOLPH	132495	0	64380	205.8	.0
INDIANA	CRAWFORD	239580	0	18946	*****	.0
INDIANA	MADISON	39930	0	75115	53.2	.0
INDIANA	MARION	2904	0		*****	*****
INDIANA	MARTIN	290400	290400	11180	*****	*****
INDIANA	MONROE	2904	0	242360	1.2	.0
INDIANA	PERRY	18513	0	37210	49.8	.0
IOWA	BLACK HAWK	296208	0		*****	*****
IOWA	CLAYTON	58080	0	36982	157.0	.0
IOWA	DES MOINES	0	272250	8799	.0	*****
IOWA	HAMILTON	32670	0	31038	105.3	.0
IOWA	JONES	36300	0	32756	110.8	.0
IOWA	LOUISA	39930	0	18824	212.1	.0
IOWA	MARION	29040	0	49703	58.4	.0
IOWA	MARSHALL	2904	0	74057	3.9	.0
IOWA	POWESHIEK	0	72600	35731	.0	203.2
IOWA	SCOTT	196020	0	5098	*****	.0
IOWA	STORY	21780	0	124410	17.5	.0
IOWA	VAN BUREN	217800	0		*****	*****
IOWA	WASHINGTON	39930	0	26591	150.2	.0
IOWA	WEBSTER	29040	0	79885	36.4	.0
KANSAS	ATCHISON	159720	0	51294	311.4	.0
KANSAS	BARBER	145200	0	23687	613.0	.0
KANSAS	ELLSWORTH	0	217800	12879	.0	*****
KANSAS	JOHNSON	419265	0		*****	*****
KANSAS	LEAVENWORTH	21780	0	5772	377.3	.0
KANSAS	MARSHALL	0	246840	39743	.0	621.1
KANSAS	RENO	0	166980	59797	.0	279.2
KANSAS	RICE	0	192390	43837	.0	438.9
KANSAS	WYANDOTTE	116160	0		*****	*****
KENTUCKY	ANDERSON	5082	0	36288	14.0	.0

MINE SHELTERING CAPABILITY REPORT

STATE	COUNTY	DRIFT MINE SPACES	OTHER MINE SPACES	POST-RELOCATION POPULATION	PERCENTAGE SHELTERED IN DRIFT MINE SPACES	PERCENTAGE SHELTERED IN OTHER MINE SPACES
KENTUCKY	FAYETTE	6170	0		*****	*****
KENTUCKY	FRANKLIN	3085	0	89637	3.4	.0
KENTUCKY	GARRARD	1452	0	20899	6.9	.0
KENTUCKY	JEFFERSON	363	0		*****	*****
KENTUCKY	JESSAMINE	4719	0	50270	9.4	.0
KENTUCKY	LEE	2359	0		*****	*****
KENTUCKY	MASON	0	47560	36393	.0	119.7
KENTUCKY	OLDHAM	3993	0		*****	*****
KENTUCKY	PENDLETON	0	14549040	23985	.0	*****
KENTUCKY	WOLFE	1996	0		*****	*****
LOUISIANA	IBERIA	0	124146	60185	.0	206.3
LOUISIANA	ST MARY	0	108900	161177	.0	67.6
MAINE	PISCATAQUIS	0	726	20080	.0	3.6
MARYLAND	BALTIMORE	14520	0	21855	66.4	.0
MARYLAND	GARRETT	21780	0	116942	18.6	.0
MICHIGAN	GOGEBIC	0	2904		*****	*****
MICHIGAN	KENT	0	7260	68728	.0	10.6
MICHIGAN	MARQUETTE	0	1452	49658	.0	2.9
MICHIGAN	ONTONAGON	36300	0		*****	*****
MICHIGAN	WAYNE	0	36300		*****	*****
MISSOURI	BENTON	50820	0		*****	*****
MISSOURI	BOONE	1452	0		*****	*****
MISSOURI	CAMDEN	50820	0		*****	*****
MISSOURI	CLAY	726000	0		*****	*****
MISSOURI	GREENE	130680	0		*****	*****
MISSOURI	IRON	0	508200	36634	.0	*****
MISSOURI	JACKSON	646140	0		*****	*****
MISSOURI	JASPER	76956	0	308539	24.9	.0
MISSOURI	JEFFERSON	447216	0		*****	*****
MISSOURI	KNOX	13068	0	16049	81.4	.0
MISSOURI	MADISON	0	72600	30828	.0	235.5
MISSOURI	NEWTON	36300	0	137454	26.4	.0
MISSOURI	RALLS	21780	0	30916	70.4	.0
MISSOURI	REYNOLDS	0	508200	21649	.0	*****
MISSOURI	STE GENEVIEVE	743424	0	41611	*****	.0
MISSOURI	ST LOUIS	50820	0	325	*****	.0
MISSOURI	TANEY	8712	0	79633	10.9	.0
MISSOURI	WASHINGTON	0	145200	41478	.0	350.1
MONTANA	BEAVERHEAD	10527	0	21066	50.0	.0
MONTANA	BROADWATER	5808	0		*****	*****
MONTANA	CASCADE	0	4356		*****	*****
MONTANA	FERGUS	72600	1452		*****	*****
MONTANA	GRANITE	44286	2904	5341	829.2	54.4
MONTANA	JEFFERSON	1452	0	21225	6.8	.0
MONTANA	LEWIS AND CLARK	7260	0	73104	9.9	.0
MONTANA	LINCOLN	77682	0		*****	*****
MONTANA	MADISON	29766	0	11812	252.0	.0
MONTANA	MISSOULA	2904	0	105436	2.8	.0
MONTANA	POWELL	73326	0	16458	445.5	.0
MONTANA	SANDERS	20328	0		*****	*****
MONTANA	SILVER BOW	2904	0	60	*****	.0
MONTANA	STILLWATER	2904	0	12267	23.7	.0
NEBRASKA	CASS	776820	0	50046	*****	.0
NEVADA	CLARK	1452	0	218046	.7	.0
NEVADA	DOUGLAS	2904	0	60379	4.8	.0
NEVADA	ELKO	8712	0		*****	*****
NEVADA	ESMERALDA	4356	0		*****	*****

MINE SHELTERING CAPABILITY REPORT

STATE	COUNTY	DRIFT MINE SPACES	OTHER MINE SPACES	POST-RELOCATION POPULATION	PERCENTAGE SHELTERED IN DRIFT MINE SPACES	PERCENTAGE SHELTERED IN OTHER MINE SPACES
NEVADA	EUREKA	2904	0	2286	127.0	.0
NEVADA	HUMBOLT	1452	0	31036	4.7	.0
NEVADA	LANDER	10164	0	4659	218.2	.0
NEVADA	LINCOLN	2904	58080	52963	5.5	109.7
NEVADA	LYON	2904	0	16516	17.6	.0
NEVADA	MINERAL	17424	0	5727	304.2	.0
NEVADA	NYE	8712	4356	143048	6.1	3.0
NEVADA	PERSHING	4356	0	17150	25.4	.0
NEVADA	STOREY	4356	0	5665	76.9	.0
NEVADA	WHITE PINE	5808	0		*****	*****
NEW JERSEY	SUSSEX	0	49005	722099	.0	6.8
NEW MEXICO	EDDY	0	588060	103887	.0	566.1
NEW MEXICO	GRANT	16153	57717	65259	24.8	88.4
NEW MEXICO	LEA	0	90750	127923	.0	70.9
NEW MEXICO	LINCOLN	6534	0	23752	27.5	.0
NEW MEXICO	MCKINLEY	0	13068	60551	.0	21.6
NEW MEXICO	SANTE FE	16698	0	141264	11.8	.0
NEW MEXICO	SIERRA	96558	13068		*****	*****
NEW MEXICO	TAOS	43560	0	50809	85.7	.0
NEW MEXICO	VALENCIA	72600	78408	156060	46.5	50.2
NEW MEXICO	UNKNOWN COUNTY	0	3630		*****	*****
NEW YORK	ESSEX	72600	0	126674	57.3	.0
NEW YORK	GENESEE	0	108900	310518	.0	35.1
NEW YORK	LEWIS	29040	0	117927	24.6	.0
NEW YORK	LIVINGSTON	0	4900500	194148	.0	*****
NEW YORK	ST LAWRENCE	348480	0	520423	67.0	.0
NEW YORK	TOMPKINS	0	726000	504369	.0	143.9
OHIO	CUYAHOGA	0	1306800		*****	*****
OHIO	LAKE	0	1452000		*****	*****
OHIO	LAWRENCE	1452000	0	15485	*****	.0
OHIO	MORGAN	0	1452	46460	.0	3.1
OHIO	MUSKINGUM	1452000	0	478666	303.3	.0
OHIO	SUMMIT	1452000	0		*****	*****
OHIO	TUSCARAWAS	1452	0	371788	.4	.0
OKLAHOMA	SEQUOYAH	108900	0		*****	*****
OREGON	BAKER	24321	0	37486	64.9	.0
OREGON	CLACKAMAS	1452	0		*****	*****
OREGON	GRANT	3630	0		*****	*****
OREGON	HARNEY	1452	0		*****	*****
OREGON	JOSEPHINE	3630	0	127122	2.9	.0
OREGON	LANE	1452	0	93718	1.5	.0
PENNSYLVANIA	ARMSTRONG	127050	0	70425	180.4	.0
PENNSYLVANIA	BUTLER	7260	0	248249	2.9	.0
PENNSYLVANIA	CENTRE	373890	36300	534332	70.0	6.8
PENNSYLVANIA	FAYETTE	30492	0	631436	4.8	.0
PENNSYLVANIA	JEFFERSON	27225	0		*****	*****
PENNSYLVANIA	LEHIGH	145200	0	249349	58.2	.0
PENNSYLVANIA	SOMERSET	14520	0	80002	18.1	.0
PENNSYLVANIA	WESTMORELAND	72600	0	529957	13.7	.0
PENNSYLVANIA	YORK	72600	0		*****	*****

DISTRIBUTION LIST

Federal Emergency Management Agency
Research Office
Attn: Assistant Associate Director
National Preparedness Programs
Washington, DC 20472 (60)

Assistant Secretary of the Army (R&D)
Attn: Assistant for Research
Washington, DC [illegible]S

Defense Technical Information Center
Cameron Station
Alexandria, VA 22314 (12)

Oak Ridge National Laboratory
Attn: Librarian
P. O. Box X
Oak Ridge, TN 37830

Mr. Phillip M. Smith,
Associate Director
Natural Resources & Community Services
Office of Science and Technology Policy
Executive Office Building
Washington, DC 20500

Los Alamos Scientific Laboratory
Attn: Document Library
Los Alamos, NM 87544

The RAND Corporation
Attn: Document Library
1700 Main Street
Santa Monica, CA 90401

Chief of Naval Research
Washington, DC 20306

Mr. Thomas Waterman
IITRI
10 West 35th Street
Chicago, IL 60616 (2)

Emergency Technology Division
Oak Ridge National Laboratory
Attn: Librarian
Oak Ridge, TN 37830

Director
Lovelace Foundation
5200 Gibson Boulevard, S.E.
Albuquerque, NM 87108

Commanding Officer
U.S. Naval C.E. Laboratory
Attn: Document Library
Port Hueneme, CA 93401

Director, Army Materials and
Mechanics Research Center
Attn: Technical Library
Watertown, MA 02172

Civil Engineering Center
AF/PRECET
Wright Patterson Air Force Base
OH 45433

Air Force Weapons Laboratory
Attn: SUL Technical Library
Kirtland Air Force Base
Albuquerque, NM 87117

Mr. Lewis V. Spencer
Room C313-Building 245
Washington, DC 20234

Mr. Samuel Kramer, Chief
Office of Federal Building
Technology
Center for Building Technology
National Bureau of Standards
Washington, DC 20234

Director, U.S. Army Engineer
Waterways Experiment Station
Attn: Document Library
P. O. Box 611
Vicksburgh, MI 39180

Director, U.S. Army Ballistic
Research Laboratory
Attn: Document Library
Aberdeen Proving Ground, MD 21005

Dr. William Chenault
Human Sciences Research, Inc.
Westgate Industrial Park
7710 Old Springhouse Road
McLean, VA 22102

Mr. Raymond Alger
SRI International
Menlo Park, CA 94025

Mr. John Rempel
Center for Planning and Research
2483 East Bayshore
Palo Alto, CA 94303

Mr. James Beck Associates
4216 Los Palos Avenue
Palo Alto, CA 94306

Dr. John Cockayne, Senior Scientist
Science Applications, Inc.
1710 Goodridge Drive
P. O. Box 303
McLean, VA 22101

Mr. Leo A. Schmidt
Institute for Defense Analyses
Program Analysis Division
400 Army-Navy Drive
Arlington, VA 22202

Applied Research and Associates
Attn: Cornelius J. Higgins
2601 Wyoming Boulevard, Suite H-1
Albuquerque, NM 87112

Mr. Kenneth Kaplan
Management Science Associate
P. O. Box 239
Los Altos, CA 94025

Dr. Clarence R. Mehl
Division 1112
Sandia National Laboratories
P. O. Box 5800
Albuquerque, NM 87185

AFWL/Civil Engineering Division
Kirtland Air Force Base
NM 87117

Mr. Jud Leech
BDM Corporation
1801 Randolph Road, S.E.
Albuquerque, NM 87106

Gard, Inc.
7449 North Natchez Avenue
Niles, IL 60648

Mr. Donald A. Bettge
Office of Civil Preparedness
National Preparedness Programs
Federal Emergency Management
Agency
Washington, DC 20472

Mr. W. L. Huff
USAE Waterways Experiment Station
P. O. Box 631
Vicksburg, MI 39180

Director, Defense Nuclear Agency
Attn: Technical Library
Washington, DC 20305

Mr. Carl Wiehle
Defense Intelligence Agency
Attn: CKW DB-4C2
Washington, DC 20301

Mr. C. Wilton
Scientific Service, Inc.
517 East Bayshore Drive
Redwood City, CA 94060 (2)

Mr. Fred Sauer
Physics International Company
2700 Merced Street
San Leandro, CA 94577

Dikewood Corporation
1613 University Boulevard, N.E.
Albuquerque, NM 87102

Mr. Edward L. Hill
Research Triangle Insitute
P. O. Box 12194
Research Triangle Park, NC 27709

Chief of Engineers
Department of the Army
Attn: ENGEME-RD
Washington, DC 20314

Mr. Joseph E. Minor
Texas Technological College
Lubbock, TX 79408

H. L. Murphy Associates
P. O. Box 1727
San Mateo, CA 94401

Professor R. K. Pefley
University of Santa Clara
Santa Clara, CA 95053

Mr. R. G. Hickman
Lawrence Livermore National Laboratory
University of California
P. O. Box 808
Livermore, CA 94550

Mr. William Taylor
Ballistic Research Laboratories
Aberdeen Proving Grounds
MD 21005 (2)

Dr. Ben Sussholz
R1/2094
TRW
One Space Park
Redondo Beach, CA 90278

RESEARCH TRIANGLE INSTITUTE, Research Triangle Park, North Carolina
Work Unit 1611C
FEMA Contract No. EMW-C-0707
National Underground Mines Inventory
Wright, M. D., W. Chessin, K. Reeves, S. York, III
October 1983 (Unclassified) 84 pages

The purpose of this study was to identify and, to the extent that data are available, to characterize the underground, non-coal mines in the United States and to assemble the data obtained into a national inventory of underground mines having the potential of providing lodging and shelter as a civil defense measure during a natural or man-made disaster. Data were collected from the Mine Safety and Health Administration, the U.S. Bureau of Mines, from discussions with mine inspectors, and from mine owners and operators during visits to six underground mines. The data collected were incorporated into a computerized underground mine data file at the FEMA/Olney Computer Center.

RESEARCH TRIANGLE INSTITUTE, Research Triangle Park, North Carolina
Work Unit 1611C
FEMA Contract No. EMW-C-0707
National Underground Mines Inventory
Wright, M. D., W. Chessin, K. Reeves, S. York, III
October 1983 (Unclassified) 84 pages

The purpose of this study was to identify and, to the extent that data are available, to characterize the underground, non-coal mines in the United States and to assemble the data obtained into a national inventory of underground mines having the potential of providing lodging and shelter as a civil defense measure during a natural or man-made disaster. Data were collected from the Mine Safety and Health Administrat the U.S. Bureau of Mines, from discussions with mine inspectors, and from mine owne and operators during visits to six underground mines. The data collected were incorporated into a computerized underground mine data file at the FEMA/Olney Compute Center.

RESEARCH TRIANGLE INSTITUTE, Research Triangle Park, North Carolina
Work Unit 1611C
FEMA Contract No. EMW-C-0707
National Underground Mines Inventory
Wright, M. D., W. Chessin, K. Reeves, S. York, III
October 1983 (Unclassified) 84 pages

The purpose of this study was to identify and, to the extent that data are available, to characterize the underground, non-coal mines in the United States and to assemble the data obtained into a national inventory of underground mines having the potential of providing lodging and shelter as a civil defense measure during a natural or man-made disaster. Data were collected from the Mine Safety and Health Administration, the U.S. Bureau of Mines, from discussions with mine inspectors, and from mine owners and operators during visits to six underground mines The data collected were incorporated into a computerized underground mine data file at the FEMA/Olney Computer Center.

RESEARCH TRIANGLE INSTITUTE, Research Triangle Park, North Carolina
Work Unit 1611C
FEMA Contract No. EMW-C-0707
National Underground Mines Inventory
Wright, M. D., W. Chessin, K. Reeves, S. York, III
October 1983 (Unclassified) 84 pages

The purpose of this study was to identify and, to the extent that data are available, to characterize the underground, non-coal mines in the United States and to assemble the data obtained into a national inventory of underground mines having the potential of providing lodging and shelter as a civil defense measure during a natural or man-made disaster. Data were collected from the Mine Safety and Health Administration, the U.S. Bureau of Mines, from discussions with mine inspectors, and from mine owners and operators during visits to six underground mines. The data collected were incorporated into a computerized underground mine data file at the FEMA/Olney Computer Center.